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J952-7

annual report

To the Congress for 1982

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D. C. 20510

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Section I.—Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA

CHAIRMAN'S STATEMENT— SENATOR TED STEVENS

The Office of Technology Assessment (OTA) is now a decade old. In March 1982, the Senate Committee on Rules and Administration held oversight hearings on the progress of OTA. Witnesses from both the public and private sectors testified to the high quality of OTA's products. The hearings demonstrated that in the last several years OTA has developed a track record of competence. In 1982, OTA's resources were used by 89 different congressional committees and subcommittees, signaling the usefulness of the Agency's work.

In these days of continued pressure on the Nation's finances, legislators must have access to unbiased, timely, and understandable information on which to base decisions about expensive technological activities. For example, OTA's report on the Management of High-Level Nuclear Waste was a useful reference during consideration of that highly controversial issue in the last Congress. The Agency is currently studying other topical issues for Congress such as: wetlands, natural gas availability, U.S. world competitiveness in space, electronics, biotechnology, and automation in the workplace.

OTA is designed to provide both Houses of Congress with unbiased information on technological issues facing Congress. During the last 2 years, OTA's shared staff has lessened the duplication of studies often found in the legislative process. And OTA has done so without losing the necessary objectivity of its work.

VICE CHAIRMAN'S STATEMENT—CONGRESSMAN MORRIS K. UDALL

OTA, now in its tenth year, has passed something of a milepost. I have been a Member of its Board since OTA was established, and it is heartening to note that bipartisan requests now come routinely from congressional committees whose chairmen and ranking minority members each view OTA as a key source of assistance.

Technology plays a critical role in a whole host of legislative areas: in upgrading our national defense, in reducing our dependence on foreign oil, in preserving the health of our people, in boosting the productivity of our workers, in keeping America competitive in international trade, and in providing adequate water for domestic agricultural and industrial use. To be able to make informed decisions on technological issues, it is essential that Congress receive unbiased information and the best analyses available. OTA's authorizing legislation gives it that task. In addition, OTA is charged with keeping Congress abreast of emerging sociotechnological issues. That dual role is not easy, but it is vital.

OTA has acquired an international reputation for excellence. It is always difficult to provide hard measures of quality, but it is surely indicative that OTA's reports are among GPO's "best sellers;" commercial publishers are now reprinting many OTA studies; and some have been translated and published abroad. Media attention to OTA's reports has grown steadily. Foreign interest has increased rapidly. Several countries are considering establishing agencies analogous to OTA. Most importantly, the volume of congressional requests for OTA assistance has risen steadily.

Several OTA assessment activities were of particular value in 1982. The studies on transported air pollutants were frequently used by the Senate and House committees dealing with amendments to the Clean Air Act. OTA's analyses about the costs and benefits of reducing pollution emissions as well as their downwind effects were heavily utilized by committees, particularly since so much difference of opinion still exists on these issues. Similarly, OTA's pathfinding work on how to proceed with management of high-level nuclear wastes was extremely well received by both House and Senate committees. Its work had a significant and positive influence on congressional efforts to resolve this protracted, vexing, and most challenging issue.

Members of the Technology Assessment Advisory Council meet to provide guidance and direction to the OTA Director

TAAC CHAIRMAN'S STATEMENT—CHARLES N. KIMBALL

The Technology Assessment Advisory Council (TAAC) met in November 1982 for its semiannual review of OTA's progress. This most recent TAAC meeting was held just a decade after the creation of OTA by Congress. A number of observers in the early 1970's had felt that 10 years would likely be required for the agency to get into full gear, due to the great complexity of the issues it should tackle, the lack of existing models for technology assessment in 1972, and the difficulty of effectively resolving conflicting information. TAAC's impression is that OTA is now operating with great effectiveness, utilizing information from a diversity of sources, and producing first-rate, high-quality products.

At its November meeting, TAAC reviewed several current projects characteristic of OTA's work related to technology and industrial competitiveness. We found the studies to be well-organized and a good mixture of present issues (international competitiveness in electronics) and emerging opportunities (workplace automation; biotechnolgy). The results should provide broad insights into the nature of the national economy. The question of understanding structural change in the U.S. economy as it is affected by technological change, demographic change, and Federal policies is increasingly important. Therefore, one must encourage OTA's attempts to move toward an even more comprehensive examination of the future of the domestic economy.

We also reviewed the videotape OTA has produced on the Soviet gas pipeline issue, which presents the issues, opinions, and policy options clearly and objectively. This use of audiovisuals to supplement a formal report can be very helpful in transferring a considerable amount of information in a brief period while clarifying complicated technical details.

Most importantly, we are reassured by the *process* through which OTA carries out its studies. OTA's use of advisory panels, its search for all sources of expertise, and its procedure of soliciting both internal and external review of draft material provide TAAC with assurance that final OTA products will be technically accurate and understandable.

DIRECTOR'S STATEMENT—JOHN H. GIBBONS

The world is less than two decades into learning how to conduct formal technology assessments. Proposals to create a U.S. Office of Technology Assessment (OTA) were widely discussed in the United States during the 1960's, partly due to controversy that surrounded technologies such as long-lived pesticides and the SST. The situation seemed to be rather straightforward:

1. the world was becoming inescapably dependent on technology for its well-being, if not its survival;
2. virtually all nations looked to technology as their main hope for economic growth;
3. the advent of new, powerful technologies were creating a situation in which the margin for error without large penalty was getting perilously thin; and
4. policymakers recognized the need to improve the means to analyze more carefully and with greater foresight the implications (for good and for bad) of science and the applications of technology.

Congress established OTA 10 years ago. Since then interest in technology assessment has risen both in Congress and worldwide, driven by the necessity to gain not only a better understanding of the complex issues we face but also of the plausible options to deal productively with those issues.

What is New

The "goods" and "bads" of technology have been explicitly recognized for at least two millenia. More recently, but still a century ago, Ralph Waldo Emerson captured the issue in two sentences: "Nature never gives anything to anyone; everything is sold. It is only in the abstractions of ideas that choice comes without consequence." What is new is the present attempt to apply analytical methods from a variety of perspectives (e.g., diverse disciplines and parties of interest) to an issue and then to synthesize and integrate the results to address the full array of impacts.

The Shape of the Future

Technology assessment (as practiced by OTA) is not, and should not be, oriented toward forecasting the future, but rather toward gaining more reasoned information about how different policy actions could influence or shape the future. As C. P. Snow remarked, "A sense of the future is behind all good politics. Unless we have it, we can give nothing—either wise or decent—to the world."

How can one do a future-oriented technology assessment without making forecasts or predictions? The answer is not hard. Rather than trying to set each of many parameters at their "most likely" value and then forecasting a future condition, one can identify the parameters and make alternative projections of outcomes based on different, explicit assumptions about key parameters or events. This enables one to gain a sense of how the future could be shaped by actions taken between now and then—but not a prediction of what the future will be.

Gaining Understanding

When technology assessment was first undertaken, it was sometimes viewed with considerable suspicion. OTA, for example, in its earlier years had been called (not entirely with tongue-in-cheek) the "Office of Technology Harassment." Fortunately, it also was labeled by some different observers the "Office of Technical Assistance." Such concerns can be overcome by demonstrating—both by the process of review, and content of the product—that advocacy and bias have been avoided. The process of substantial involvement of diverse parties at interest, plus extensive review and critiques of draft material helps ensure quality and minimizes the chances for bias in the final results.

The OTA Approach

A great advantage of OTA is the fact that its framers were able, by taking advantage of the structure of American political parties and the separate establishment of executive and legislative branches, to craft a strictly bicameral and bipartisan organization. Such a procedure is not readily adaptable to other forms of government. However, it appears that most of the procedures employed by OTA are, to a very large degree, widely transferable. This includes the use of external advisers, reviewers, and contractors to supplement an in-house analytical staff, in a well-tested process of focusing the best minds and using the best information available on issues. The OTA staff structures the work, analyzes and integrates the individual tasks of the study, writes the report, and is involved in the extended process of delivering the information (publications, briefings, testimony) to the policy decisionmakers.

Common Issues and Concerns

Sociotechnical problems faced by the world's industrialized nations are very similar in nature. Assessments commonly encountered in different countries include energy (supplies, wastes, and utilization); environment (air pollution, water supplies); innovation and competitiveness as influenced by technology (electronics, steel, agriculture, space); automation in production and service industries (automobiles, finance); and health care (costs and benefits), to name a few. In other words, they have to do with the constant struggle, independent of political structure, of societies to achieve and maintain their wants and needs. The analytical methods used to investigate these issues are comparable from one country to another, and there is much to gain by sharing successes and shortcomings. The actual transfer and use of results in the political decision process also has many similarities among nations, but it is clear that the process must be carefully and individually tailored to the audience. One reason for this is that policymaking is a very delicate and complex process, frequently relying on personal interactions. Unless the results of technology assessments can be transformed into a format that is compatible with the realities and workings of the policy decision world, one cannot hope that the work will have much direct value.

Communication of Findings

The translation and communication of the results of a technology assessment is a challenging process. Results must be laid out carefully in terms of findings and conclusions, but the relevant policy choices should be discussed in terms of options and alternatives in a way that does not preempt those charged with actually making choices and decisions. The line between findings and conclusions *versus* recommendations can be fine but the distinction must always be made. Several examples from OTA's past experience might help to illustrate this point:

- In a study of Government vaccine immunization programs, OTA found evidence strongly confirming this approach to be cost effective as a public health measure. While no specific "recommendation" was made by OTA, Congress decided to act on the basis of those facts.
- OTA examined Soviet energy production and resolved apparent earlier conflicts over projected supplies. It also identified natural gas exports to Western Europe as a key issue. The assessment pointed out the limited utility of the United States taking unilateral action to try to stop the Soviet gas pipeline.
- In an analysis of alternative basing modes for the MX missile, a number of specific findings were made about relative strengths and weaknesses of different basing options. As a consequence, one could favor one or another (or none) of the alternatives depending on the relative degree of importance one placed on such parameters as sensitivity of vulnerability to technological change, time needed to deploy, and cost. Thus, the study did not recommend just one alternative but allowed decisionmakers to make choices on the basis of their own explicit policy judgments.
- During the process of examining the issue of high-level commercial nuclear waste disposal, OTA discovered a series of interlocking steps that, if taken together, seemed to point to a way to resolve this multidecade problem. In this study, the plausible "options" were so few, and the views of widely different parties of interest so strongly developed, that OTA's findings and conclusions did point more to a single integrated plan for action than to a set of different alternatives. Some policymakers have expressed their opinion that more assessments such as this are needed.

Where We Are Going

Information derived from OTA assessment analyses must be packaged carefully, keeping clearly in mind the needs of the ultimate customer. While the nominal completion of an assessment is the publication of a formal report, the actual delivery of the results of a technology assessment is most effective when it consists of a process, extending over time and containing a variety of forms both written and oral. This fact underscores the value of having a full-time staff located close to the seat of government that can effectively gather, integrate, translate, and deliver information.

While the news of late seems to be mostly good in terms of the perceived value of technology assessment to policy decisionmakers, there is little room for complacency. First of all, the need for more socially adaptable technology—to respond to the burgeoning challenges of economic growth, avoidance of international conflicts, environmental improvement, and social equity and justice—has never been greater. As this process accelerates and as increasingly powerful technologies are developed, we encounter narrowing margins for error. There are critical errors in these areas whose cost can be enormous. Hence, the methods of analysis and means of delivery of technology cannot afford to be merely good—they must be very good and constantly improved.

Second, the time allowed for policy decisionmaking in most cultures is characteristically shorter than the time inherently required for the kind of careful and comprehensive analysis as characterized in a technology assessment. Answers are usually needed very quickly by decisionmakers after the questions are identified. That can result in superficial responses unless the questions can be anticipated with sufficient leadtime to enable thoughtful analysis to occur before the answers are needed. Therefore, we must continue to work in two areas related to timeliness: 1) develop ways to do a better job of anticipating the policy debate, preferably 2 years or more in advance, and to scope the analysis so that it can be carried out in time; and 2) develop ways to provide decisionmakers with timely information drawn from an ongoing assessment while still continuing the analysis. Obviously, such information cannot be as comprehensive as that from a completed project, but a fundamental lesson that technology assessment practitioners must understand is the extraordinary time-value of information in the policy decision process.

Finally more attention needs to be given to the integration of results from interrelated groups of assessments. For example, one can do separate assessments of the impacts of energy development, agriculture, industrial and population growth, or defense activities on water and other resource demands in the Southwestern United States. But what of their combined impacts? Integration is essential if we are to gain a clear perspective of the relationship and tradeoffs among major national goals and priorities. To do so requires a high level of synthesis of information—a notoriously difficult thing to do. But, as a wife responded to her husband's complaint about growing old: "consider the alternative."

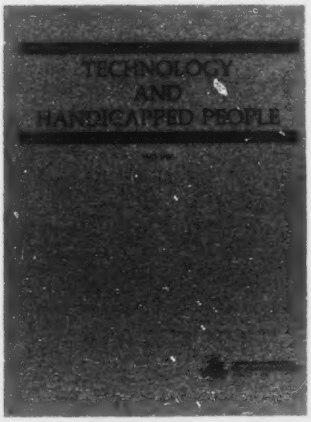
Section II.—Year in Review

The assessments carried out by OTA cover a wide spectrum of major issues that Congress and the country are facing. They examine a broad range of policy options and their potential impacts. To provide examples of the breadth and depth of OTA's work, a brief summary of each report, published by the Office in 1982 are presented in this section. Also included are synopses of Background Papers and Technical Memoranda issued by OTA on specific subjects analyzed in recent OTA reports or on projects in progress at OTA. Background Papers and Technical Memoranda are neither reviewed nor approved by the Technology Assessment Board.

The reader is cautioned that these are synopses of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.

Technology and Handicapped People

Technology's great potential for aiding disabled people has not been fulfilled. There are numerous problems related to the development and distribution of assistive technologies, and many of them could be avoided or lessened. The most serious barriers to the effective use of technology are social ones—e.g., inconsistent and often inadequate financing for the acquisition or use of technologies, conflicting and ill-defined goals, and uncoordinated public programs.



TECHNOLOGY
AND
HANDICAPPED PEOPLE

Despite problems, technology is a pervasive and critical influence in the life of every disabled person. More disabled people have access to more technologies than ever before. Emerging and future technologies hold even greater promise.

OTA highlights the necessity of considering not only the individuals with disabilities but also the environments in which they function. A disability results in a handicap when the disabled person interacts with the physical and social environments. Use of a wheelchair due to a disability, for example, becomes a handicap when the environment (transportation, worksite, employer attitudes) is not compatible with a wheelchair.

OTA presents policy options for Congress that might lessen problems in the development, distribution, and use of technologies. The report contains a range of options in five issue areas: consumer involvement, production and marketing of technologies, evaluation of current and emerging technologies, financial barriers to technology acquisition or use, and personnel availability.

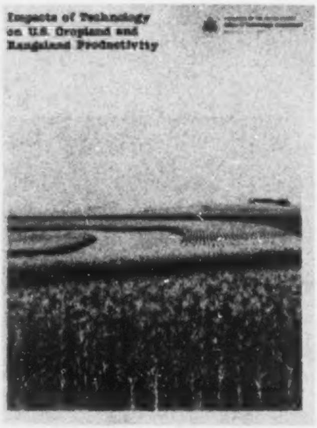
Disability-related research and development (R&D) is highly innovative. Advances in solid-state electronics, other communications and information technologies, biomedical knowledge, and new alloys provide dramatic new possibilities. The U.S. Government spends approximately $66 million a year on R&D related to technologies for disabilities. These expenditures, however, are equal to only a small percentage of the social costs due to disability—e.g., payments to support the income of disabled people are 500 times greater than the Federal investment in R&D.

A focused and adequately funded program to evaluate technologies is needed, especially in view of the increased pace of technological innovation in this area. Evaluation is often performed in an oversimplified fashion with insufficient funding. Because evaluations frequently do not systematically use criteria such as reliability, cost, repairability, or reimbursement status, their utility is reduced.

For diffusion and marketing of technologies, the public-private sector relationship is particularly important. There are several examples of products developed under a Federal R&D program that have been subsequently marketed by private firms. Yet these successes appear to be exceptions; the market is ill-defined, disability-related technologies often do not appear financially viable, and financing or reimbursement systems sometimes provide disincentives to the marketing of certain types of technologies.

Over 100 Federal and other programs enhance or support the use of technologies by disabled people. Such programs include income maintenance, health care, social services, educational services, vocational rehabilitation, and independent living services. Issues related to the use of technologies include coordination of services, eligibility determination, device maintenance, consumer involvement, and shortage of providers.

Impacts of Technology on U.S. Cropland and Rangeland Productivity



Impacts of Technology
on U.S. Cropland and
Rangeland Productivity

Agricultural production need not be harmful to the quality of the land. On the contrary, production and conservation can be compatible, even on marginal land, if appropriate production technologies are developed and used.

Nonetheless, certain processes that harm the land's long-term productivity, especially erosion, are widespread and serious. Every year, U.S. cropland erodes at an average rate of 7 tons per acre. Yet soil is thought to form at a rate of only one-half ton or less per acre annually. Thus, it seems that America's agricultural land is eroding more than 10 times faster than it is forming.

Other processes related to agriculture also damage the productivity of the Nation's croplands and rangelands, including compaction, inadequate drainage, salinization, livestock mismanagement, ground water depletion, and land subsidence. However, data on the causes, consequences, and solutions for these problems are generally inadequate.

On the whole, U.S. land productivity is deteriorating gradually. But neither the problems nor the potential solutions can be broadly generalized. Both the degradation problems and the technological solutions are largely site-specific. If Federal policy is to be effective in preserving and enhancing land productivity, it must accommodate the Nation's great regional and local diversity.

For most agricultural land, technologies exist that can foster high production while maintaining land quality without sacrificing short-term profit potential. The most important new technologies to control erosion in the near future will be methods and equipment designed to minimize tillage on row and small grain cropland—i.e., technologies that also maintain or enhance farm profits.

There are some particularly fragile lands, however, where no such technologies are currently available. These lands are used for agriculture because it is profitable, with existing technologies, markets, and policies, to "mine" the land's inherent productivity as if it were a nonrenewable resource.

In recent years, losses in land productivity have been masked by gradual increases in capital inputs such as fertilizers, pesticides, and improved crop varieties. As the cost of these inputs rises and productivity losses become more severe, it will become increasingly difficult to sustain production on depleted agricultural land.

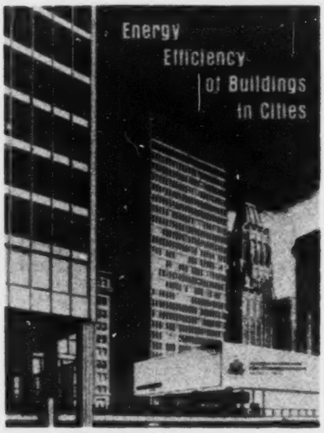
Federal agricultural programs have had mixed effects on resource conservation. While such programs intentionally or unintentionally affect the natural resource base, they generally have not been designed to provide collateral conservation benefits. Little work, in fact, has ever been done to analyze the interrelationships between agricultural policies and conservation.

Agricultural policymakers today face problems quite different from those of the past. When agricultural programs supported prices primarily by keeping land out of crop production, no major effort was required to integrate production and conservation policies. Now, with economic goals shifting to full production, additional erosion-prone or otherwise fragile land is coming into use. This makes the need to integrate production and conservation much more significant.

Opportunities for congressional action to improve land productivity occur in five policy areas: 1) integrating conservation policy with economic policy, 2) improving the effectiveness of Federal conservation programs, 3) enhancing Federal capabilities to develop innovative technologies, 4) reducing pressure on fragile lands, and 5) encouraging State initiatives.

Energy Efficiency of Buildings in Cities

By 2000, up to 7 Quads per year (equivalent to 3.5 million barrels of oil per day for 365 days) of energy savings is technically possible from investments in the energy efficiency of buildings found in cities. On the average these investments are likely to earn a high rate of return.


Energy
Efficiency
of Buildings
in Cities

Existing technology for retrofits to the building shell, space heating and cooling, hot water, and lighting systems is already sufficient to achieve sizable savings, although opportunities remain for technological development. The effectiveness of retrofit measures depends on only a few building characteristics: size, use, wall and roof type, and type of mechanical system. For almost all building types, 70 to 80 percent of all potential savings will come from retrofits that pay back in 2 to 7 years.

About one-third of this savings potential will occur if current market conditions persist. Several categories of building owners have already installed or are planning to install retrofits that pay back in 3 to 7 years. Owners investing in their buildings include institutional owners such as insurance companies and pension funds, corporations, and nationally syndicated partnerships. All have good access to equity capital, reliable professional advice on retrofits, and a long holding strategy for their buildings.

Two-thirds of the savings potential, on the other hand, is not now likely to be realized. The vast majority of building owners are individuals and small local partnerships who, by and large, are limiting retrofits to those that pay back in 1 or 2 years.

One reason is poor access to long-term financing. For most types of commercial and multifamily building owners, loans for property improvement (including energy retrofit) are only available at high interest rates (2 points above prime) and short terms (less than 2 years). Debt service on such loans for energy retrofits far exceeds the value of the first year's energy savings for all options except retrofits with a 1- to 2-year payback.

Another concern is the difficulty of predicting actual energy savings from a retrofit. The range can be 50 to 70 percent above or below predictions. Variability of energy savings from building to building is due partly to the uniqueness of each structure (including previous retrofits) and the influence of building maintenance and occupants behavior. Difficulty of prediction is exacerbated by the lack of reliable data on actual retrofit results.

In some cities, private companies are effectively marketing retrofits to small numbers of building owners. Only a handful of companies, however, have offered either retrofit financing or savings guarantees. Financial and regulatory considerations are limiting utility involvement in large-scale retrofit. OTA's analysis, including case studies of public and private energy efforts in five cities, also showed that large-scale retrofit would receive high priority in only a few cities.

Three possible options for the Federal Government are: 1) no intervention, letting the private sector develop and market the retrofit options; 2) small Federal market assistance role to improve technology and the predictability of energy savings from retrofit; and 3) large active Federal role to improve retrofit predictability and also provide financing subsidies to lower interest rates slightly and lengthen loan terms substantially.

Informational Technology and Its Impact on American Education

The "information revolution" is profoundly affecting American education and training—creating new demands for instructional services and, at the same time, providing new opportunities for the improvement and delivery of such services. Whether or not new information technologies will fulfill their potential will depend, in part, on the kinds of actions that the Federal Government takes.

Informational Technology and Its Impact on American Education

Explosive developments in new computer and communication technologies and their integration into complex national, and even worldwide, information systems have transformed the information industry into a major component of the U.S. economy. Many firms involved with producing and selling information and information technology are large, and rapidly growing. Moreover, business, in general, is beginning to treat information as an important economic resource and, like land, labor, and capital, as a factor of production.

This revolution is creating new demands on individuals, constantly changing what they must know and the skills that they must have to participate fully in society as both citizens and workers. Further automation and the continuing shift to an information economy will create a greater demand for, and place a greater premium on, basic literacy and an understanding of technology. Individuals will have to be continually educated and retrained. Lifelong education will become the norm.

Many of the institutions that have traditionally been responsible for educational services—public schools, libraries, and museums—may be unable or unwilling to adapt to meet these changing educational needs. Faced with a decline in the level of economic, social, and political resources at their disposal, many of them are having to curtail some of the services they provide. On the other hand, new profitmaking institutions are emerging to take advantage of the developing market for special kinds of educational services. As educational services are increasingly provided in the marketplace, some national educational goals may not be met and some educational benefits may become less accessible to all.

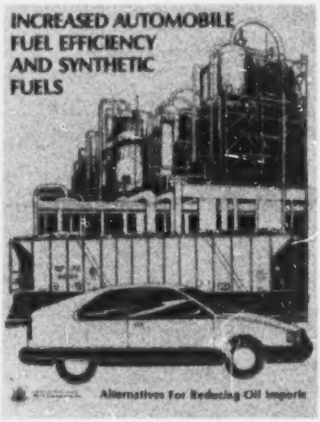
The new information technologies can help all educational institutions to meet the new demands. They include direct broadcast satellites, two-way interactive cable, low-power broadcasting, personal and handheld computers, television, video disks, and video tape cassettes. Many are already being effectively used in education and training. Experience with them proves that they can be cost effective, versatile, and are capable of being used in a variety of institutional settings. They can be used to extend education to those who have previously been denied it due to age or geographical location, socioeconomic background or physical condition. They can be interactive and engaging.

Notwithstanding the potential benefits of educational technologies, OTA has identified a number of institutional barriers to their use—among the their high initial cost, the lack of high quality programing, and the dearth of local personnel with adequate training. Experience shows that some of these barriers can be overcome if the technologies are carefully integrated into their social and institutional environments. Since public institutions may find it more difficult than profitmaking institutions to overcome these barriers, Federal action may be required to assure that the benefits of educational technologies are accessible to them.

Information technologies will be increasingly used for educational purposes. Since relatively little is known about the long-term effects on learning of substituting information technologies for more traditional teaching methods, additional research needs to be focused on this question.

Congress could take a number of specific actions to affect the development, educational application, and distribution of information technologies. For example, it might provide tax incentives for donations of computers to schools, fund teacher training programs, or support and encourage the production of high quality and economical curriculum software. But such an approach would address only a single aspect of the problem and may generate undesirable and unexpected side effects. If this is to be avoided, a broader approach, which takes into account the changing needs for education and training, considerations of equity, and changing institutional roles, will be required.

Increased Automobile Fuel Efficiency and Synthetic Fuels: Alternatives for Reducing Oil Imports


INCREASED AUTOMOBILE FUEL EFFICIENCY AND SYNTHETIC FUELS
Alternatives for Reducing Oil Imports

Even with moderate increases in auto fuel efficiency, moderate success at developing a synthetic fuels industry, and projected reductions in the stationary (nontransportation) uses of fuel oil, U.S. net petroleum imports could still exceed 4 million barrels per day (MMB/D) by 2000 (1981 imports averaged 5.4 MMB/D). Only with vigorous promotion and fortuitous technical success in all three options could the United States expect to eliminate imports before 2010.

OTA's detailed assessment of two of these alternatives—increased automobile efficiency and synfuels production—showed that projections of their contribution to import reduction vary over a wide range. For both alternatives, the higher projection is technically feasible but improbable. In particular, the synfuel upper limit would require a "war mobilization" effort, and production of even 1 MMB/D by 2000 is unlikely without the kinds of incentives offered by the Synthetic Fuels Corporation.

Projections: Average new car fuel efficiency by 2000 is likely to be at least 45 mpg but could range as high as 80 mpg, depending on the success of technical developments, demand for fuel efficiency, and the size mix of cars sold. Depending on the actual fuel efficiencies achieved, automobile fuel consumption in 2000 could be 1.3 to 2.1 MMB/D, compared with 4.3 MMB/D in 1980. Production of synthetic transportation fuels could range from negligible levels of 5 MMB/D by 2000, depending on the technical success of the first commercial plants, the level of Federal support and the comparative costs of synthetic and conventional fuels. By 1990, the U.S. Department of Energy projects stationary uses of fuel oil at 2.6 MMB/D. By 2000, 60 to 100 percent (1.5 to 2.6 MMB/D) of the remaining stationary fuel oil use could be displaced, depending on the ability and willingness of individuals and businesses to invest in conservation and fuel switching, and on successfully overcoming technical obstacles.

Costs: During the 1980's, efforts to reduce stationary oil use and to increase new-car fuel efficiency to at least 35 to 45 mpg by 1990 are likely to require less capital investment per barrel per day (B/D) of oil displaced than will synfuel production. However, in the 1990's, further increases in automobile fuel efficiency, synthetic fuels production, and further reductions in stationary uses of fuel oil all appear to require comparable investments—about $50,000 to $150,000 per equivalent B/D. Because the uncertainties in these cost estimates probably cannot be reduced to significantly lower levels before substantial investments are made, national decisions favoring one option over another for the 1990's cannot now be made simply on the basis of differentials in investment cost but require examination of other factors.

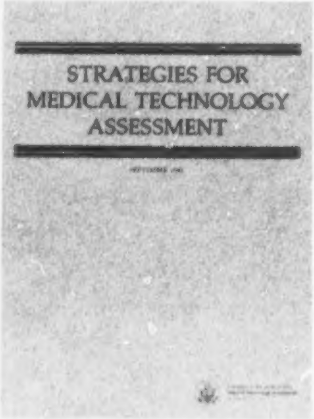
Safety and Environment: Vehicle size reductions associated with increased auto efficiency can cause increases in crash-related injuries and deaths. Improved safety design and greater seatbelt usage could offset this impact. For synfuels, important environmental damage can result from extensive coal and oil shale mining and, potentially, from release of toxic substances formed in the production process. Although such releases should be preventable, remaining regulatory gaps and scientific uncertainties prevent complacency.

Socioeconomic: Rapid increase in auto fuel efficiency will require accelerated rates of capital investment in the auto industry and may be accompanied by an accelerated demand shift towards smaller cars—a market where U.S. manufacturers historically have been weak competitors. These investments also are likely to speed the deployment of labor-saving technologies in the replacement of existing manufacturing facilities. Production by domestic and auto firms is likely to shift away from the North-Central region to other regions of the United States and to foreign countries unless countered by Government policies or production cost changes.

Rapid local population changes during synfuel plant construction and startup can lead to disruption or failure of social services in sparsely populated coal and oil shale regions. Accelerated development of a synfuels industry could also encourage the adoption of near-term technologies that may be more expensive in the long run than other synfuels options. Although from a national perspective water requirements for a large synfuels industry are small, hydrologic, institutional, and legal uncertainties prevent an unqualified conclusion about the availability of sufficient water, particularly in the West.

Strategies for Medical Technology Assessment

The Nation's current policies and processes for assessing medical technologies are inadequate to ensure that these technologies are appropriately used. A more integrated system of assessing medical technologies and spreading information about their safety, effectiveness, costs, and social effects is needed.



STRATEGIES FOR
MEDICAL TECHNOLOGY
ASSESSMENT

The Food and Drug Administration (FDA) has for many years regulated the safety and efficacy of new prescription drugs through its premarketing approval process, and since 1976 has regulated certain classes of medical devices. However, neither FDA nor any other agency systematically collects information on the incidence of long-term or rare adverse reactions to drugs approved for marketing.

New medical and surgical procedures generally originate within medical practice and are not subject to premarketing approval.

The excessive or inappropriate use of medical technologies contributes significantly to the rising costs of medical care. One problem is the lack of criteria for appropriate use on which to base reimbursement decisions. In the absence of such information, third-party payers such as Blue Cross/Blue Shield, Medicare, and Medicaid may reimburse for technologies that are not appropriately used. Furthermore, some medical and surgical procedures may become widespread before their safety and efficacy are determined.

The current system of medical technology assessment has major deficiencies in four areas: 1) identifying technologies needing assessment; 2) testing technologies to develop reliable information about their health and economic effects; 3) coordinating and synthesizing information; and 4) distributing information to Federal agencies, health care providers, third-party payers, and patients.

These deficiencies could be addressed through legislation or congressional oversight. Through oversight, for example, Congress could examine how Federal research agencies (e.g., the National Institutes of Health or the Office of Research and Demonstrations of the Health Care Financing Administration (HCFA)) might better identify technologies in need of assessment. In the area of testing, Congress could change statutes to allow HCFA, under the Medicare and Medicaid programs, to reimburse for the use of experimental technologies in return for the resulting clinical data. With regard to synthesizing information, Congress could explore why research evidence is not better evaluated by HCFA, its carriers and fiscal intermediaries when making reimbursement decisions, and by Professional Standards Review Organizations (PSROs) when setting standards for care. In the area of distributing information, Congress could encourage the National Library of Medicine to expand its literature base to include more government research reports and other nonserial literature.

Most importantly, a more integrated system of developing and distributing information about medical technologies is needed. One of the challenges is to devise a system that will meet the information needs of public and private parties, but will not hinder the innovation process. Legislative options include granting a charter to a public/private organization such as the Institute of Medicine to undertake technology assessment activities, or restoring funding for the National Center for Health Care Technology (NCHCT). As an alternative to legislative initiatives, Congress could hold oversight hearings to signal its intent that the Secretary of Health and Human Services should use existing authorities to develop a more integrated system of medical technology assessment, to endorse and encourage executive branch refunding of the NCHCT for that purpose, or to encourage the private sector (e.g., insurance companies) to take the lead in assessments.

Civilian Space Policy and Applications

Foreign competition is beginning to threaten U.S. leadership in commercially profitable space technologies. As developing European and Japanese systems become operational, the United States stands to lose significant revenues as well as prestige and influence. The situation is aggravated by the absence of overall agreement within the Federal Government about the future direction or scope of the U.S. civilian space program. The need to increase the program's effectiveness is an essential part of the broader problem of maintaining or regaining U.S. leadership in all aerospace and high-technology industries. The U.S. civilian space program is technologically capable, but it must develop more flexible policies and institutions to meet changing conditions.

CIVILIAN SPACE POLICY
AND APPLICATIONS

For the past 25 years, the United States has been the acknowledged world leader in developing and using space technology for civilian applications in the private sector and Government. However, increasing institutional and fiscal constraints, as well as the growth of foreign competition, present Congress with four key issues: What are the appropriate roles of the Federal Government and of private industry in funding or otherwise encouraging civilian space applications research, development, and demonstration? What entities should operate space systems once they are developed and demonstrated? What is the most productive relationship between the civilian and the rapidly expanding military space programs? What major new space projects, if any, should the United States embark on after the space shuttle?

In order to increase the value of space to the United States, it is important for the Government to enlist a greater share of private resources in space technology by developing innovative institutional mechanisms and incentives. In particular, it is critical to continue and encourage the transfer of federally developed technology to the private sector once significant commercial potential has been established. However, the Government continues to play a crucial role in at least four areas that are essential to the Nation's future in space: contribution to basic research and development (R&D); support of space science; provision of public goods and services; and regulation/coordination of national efforts, particularly with respect to international agreements.

OTA examined four space applications technologies that illustrate both the realities of foreign competition and the challenge of Government/industry interaction:

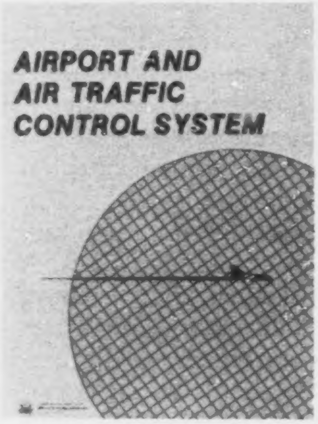
- *Satellite communications.* The National Aeronautics and Space Administration has conducted important research in two advanced communications technologies, 30/20 GHz systems and large communications platforms, but neither has been funded for demonstration. Although foreign 30/20 GHz systems are already being developed, the U.S. private sector has maintained that it cannot take the lead in such risky projects.
- *Land remote sensing* (sensing of the Earth's surface from space). There is presently no Federal commitment to provide data to U.S. and foreign users beyond the mid-1980's. Nor is the private sector willing to provide data continuity, leaving the field open to France's well-advanced SPOT remote-sensing system.
- *Space transportation.* The costs and timetable for the shuttle system remain uncertain. In addition, the small number of projected shuttle flights, and the high costs for U.S. expendables, have already caused U.S. business to purchase launch services from France's Arianespace.
- *Materials processing.* Determining the economic feasibility of manufacturing high-value, low-volume products in space will require considerable R&D by the Government and the private sector. Both Europe and Japan are pursuing extensive long-term research.

More effective use of our substantial institutional, technical, and managerial assets would require several changes. Among them are:

- closer civilian-military planning, including emphasis on technology transfer, and possible joint management and funding of common interest projects, where appropriate;
- establishment of a high-level multirepresentative body to coordinate Federal space policy;
- selected new international cooperative ventures, particularly in remote sensing; and
- reassertion of congressional leadership prerogatives and oversight direction.

A lay consideration for the future development of outer space is that it will continue to both push and be pulled by private sector involvement.

Airport and Air Traffic Control System

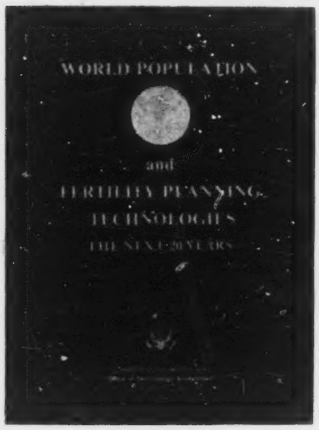


AIRPORT AND
AIR TRAFFIC
CONTROL SYSTEM

Present congestion and delay result mostly from the concentration of air traffic at a few major hubs. Changes in air traffic control equipment or procedures would allow some increases in the utilization of available capacity, but technology is only one form of response to the problems of congestion. The others are economic and regulatory. In the short term, congested airports find it more helpful to use demand management measures such as peak-hour landing fees, slot allocation quotas, or access restrictions in order to shift traffic to times or places where it can be handled more effectively.

The traffic and slot restrictions that the Federal Aviation Administration placed on busy hubs and en route centers following the Professional Air Traffic Controllers Organization strike in 1981 already impose this kind of demand management or flow control on the entire system. The report points out that these restrictions, which will remain in effect until 1984 and possibly later, raise a more fundamental policy issue: can the Nation continue its past practice of making investments to accommodate aviation growth wherever and whenever it occurs; or is growth to be managed and directed so as to make economical use of existing resources and capacity.

World Population and Fertility Planning Technologies



More than 20 new or improved contraceptive methods will be available in the next decade. The new methods will meet an important need in the United States and other developed countries, and will play a critical role in the developing world, where rapid population growth is now widely acknowledged to be a significant problem.

But the "ideal" contraceptive is likely to remain elusive; it would have to be completely effective in preventing pregnancy; have no harmful effects; be fully reversible; simple and inexpensive to produce and use, be acceptable to all governments, cultures, and religious groups; and fit the needs of all potential users at all stages of their reproductive lives. No such method exists or is expected to be developed. A more realistic goal is for each country to have enough technologies appropriate for local conditions and standards so that each couple has access to at least one that meets that couple's current needs.

Rapid population growth in the developing world is expected to account for nearly 92 percent of the projected increase in world population by 2000. It is seriously hampering efforts to raise living standards in these nations, which face high rates of disease and infant mortality, serious problems of food distribution, and severe shortages of jobs, housing, and educational opportunities.

Three-quarters of all developing country population growth in the next 18 years is projected to take place in just 18 countries, led by India, China, Brazil, Nigeria, Indonesia, Bangladesh, Pakistan, Mexico, and the Philippines.

Birth rates are falling in most of these nations, particularly in those with strong family planning programs. But the huge momentum for future growth generated by the rapidly falling death rates and continuing high birth rates of the recent past is expected to boost the yearly increase in world numbers from 80 million this year to 95 million annually by the end of the century.

All current fertility planning methods have a greater benefit than risk for the vast majority of women in developing countries because of the high incidence of mortality and complications associated with pregnancy and childbearing in these countries. Governments have thus increasingly turned to family planning programs for their maternal and family health benefits as well as for demographic reasons, and the proportion of the world's people living in countries that provide some support for family planning has risen from 10 percent in 1960 to about 90 percent today.

Although current methods are far superior to those of 20 years ago, they remain inadequate to meet the needs of users in industrialized countries and both inadequate for and beyond the reach of most couples in the developing world. When the lifetime requirements of couples who want an effective, safe, reversible, easy-to-use contraceptive for 20 to 25 years of their lives are taken into account, the disparity between present technology and desires of users is greater still.

New or better steroid hormonal contraceptives likely to be available by 1990 include safer oral contraceptives, improved long-acting injections, vaginal rings, and capsules implanted in the forearm. Chemical analogs of one of the hormones that controls ovulation—luteinizing releasing factor, or LRF—show great promise as contraceptives. LRF analogs in the form of nasal sprays, injections, suppositories, or oral capsules, which could offer the advantage of monthly rather than daily use, are likely to provide major new alternatives to the "pill."

Improved IUDs that release copper or progestins and that would need replacement only every 5 to 10 years will include a postpartum IUD that can safely be inserted following delivery. Simplified methods that a woman can use herself to accurately detect the occurrence of ovulation will benefit both users of periodic abstinence or "natural family planning" and women hoping to achieve pregnancy.

Prostaglandin analogs that induce menstruation by contracting uterine muscles when administered as vaginal suppositories, and that can also induce abortion in 90 percent of cases, are expected to be available by 1990. New and more effective barrier devices such as one-size-fits-all, spermicide-impregnated, and disposable diaphragms; vaginal films, rings, and sponges; and cervical caps that can be left in place for weeks or months are also expected by the end of the decade.

Beyond 1990, technologies for fertility planning may include a monthly pill or injection, vaccines for both women and men, simplified and fully reversible sterilization procedures, LRF analogs for self-administered induction of menstruation, and lactation-linked oral contraceptives for women.

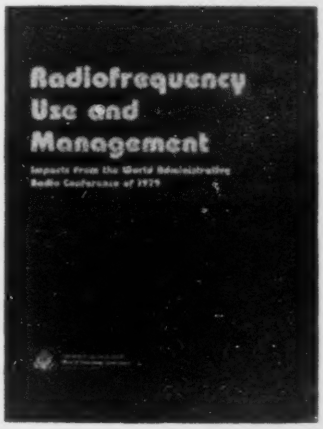
The OTA report examines the U.S. role in contraceptive research, development, and marketing, and the U.S. component of international population assistance, which amounts to just under 4 percent of total U.S. development assistance. Worldwide, population assistance totaled about $1 billion in 1980, exclusive of China. The rise in numbers of couples reaching childbearing age will increase the yearly cost of meeting the need for family planning supplies and services to a minimum of $10.7 billion in 1980 dollars by 2000, the report estimates.

Although demographers do not agree on the relative contribution of family planning programs to reducing birth rates, there is a consensus that stepped-up governmental efforts to provide family planning services would make a significant difference in the world population total in 2000. If governments take actions to meet the need for such services, the world total will be closer to the low projection (5.9 billion) than to the high projection (6.5 billion). The difference between the two projections—650 million people—is equivalent to adding three times the current U.S. population to global numbers in less than 20 years.

The study also covers the implications of current population growth, the determinants of fertility change, the factors that influence the acceptance, distribution, and use of fertility planning technologies in developing countries, and identifies related issues and options for congressional consideration.

Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979

A coordinated and consistent national policy is essential to enable the United States to effectively address critical international and domestic telecommunication issues. However, there is no clear responsibility and accountability for telecommunication policy in the U.S. Government. Lack of appreciation and concern for telecommunication issues at the top decisionmaking levels of Government and industry has resulted in a failure to assign sufficient importance to telecommunication matters, including radio spectrum management and negotiation at international conferences.



Radiofrequency
Use and
Management

Telecommunication systems are vital to U.S. economic strength and national security. With its technological proficiency, the United States has, in the past, been able to develop domestic telecommunication systems apart from the activities of other countries. However, U.S. requirements for access to the international radio spectrum and geostationary satellite orbit locations are expanding. At the same time, the international mechanism which has successfully managed the allocation of radio spectrum and allowed interference-free operation is coming under stress. This stems from the sharply increased demand for communication services and the resulting congestion in economically attractive parts of the radio spectrum.

The second general World Administrative Radio Conference (WARC-79) was convened in 1979 under the auspices of the International Telecommunication Union (ITU), a United Nations agency responsible for achieving agreement among nations in the use of telecommunications. The Final Acts of WARC-79 are to be submitted to the U.S. Senate for advice and consent to ratification. The majority of decisions relating to technical and operational issues and the international allocation of radio spectrum were acceptable to the United States. It is far from certain, however, that equally satisfactory outcomes can be achieved in future negotiations.

The Final Acts of WARC-79 reflect the rapidly growing differences among nations over the use of the radio spectrum and related satellite orbit capacity. The struggle for influence will continue at future conferences, such as the 10 major ITU international conferences scheduled over the next 7 years. If the United States is to contribute to a satisfactory resolution of international differences, U.S. Government and industry need to examine alternative means for coordinating and managing global use of the radio spectrum. Regardless of what means are implemented, the United States must begin to develop policies now that will assure that international telecommunication decisions do not jeopardize its political, economic, and national security interests.

Air Service to Small Communities

Air service to small communities is presently undergoing a rapid and sometimes disruptive transition from regulation to deregulation. Ultimately, future service will depend on the ability of commuter airlines to provide competitive service in short-haul markets. This in turn depends partly on the introduction of a new generation of cost-cutting commuter aircraft.

IMPACT OF ADVANCED
AIR TRANSPORT
TECHNOLOGY
Part III · Air Service to Small Communities

Scheduled passenger air service provides small communities with access to the Nation's primary air transportation network and plays an important part in local economic development. Between 1960 and 1978, however, 187 communities were dropped from regulated airline routes. To address this problem, the Airline Deregulation Act of 1978 guaranteed continued air service for 10 years to eligible communities, with direct Federal subsidy if necessary. The Civil Aeronautics Board established the Essential Air Service (EAS) program to implement this guarantee.

Changes in air service patterns since 1978 suggest that many small- and medium-size cities, and some States and regions, have not benefited equally from recent improvements in domestic air service. Communities in at least 34 States have appealed their EAS determinations, which they feel do not provide for adequate levels of service to maintain or develop markets in small communities. Supporters of EAS respond that it has protected eligible communities, that it was not intended to be a market-development program, and that the cost of such a program would be prohibitive.

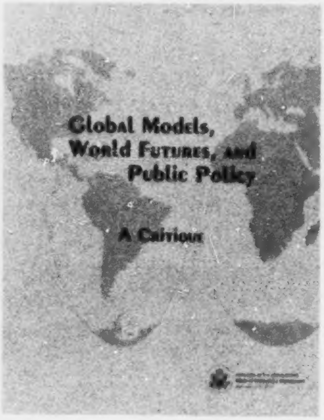
Even before 1978 regulated carriers had been replaced in many markets by unregulated, unsubsidized commuter airlines whose smaller aircraft and lower operating costs were better suited to low-density, short-haul air service. Since deregulation, commuters have replaced larger carriers in over 132 EAS-eligible communities and have also reentered previously abandoned markets.

Commuter airlines have added 1,000 aircraft to their fleets since 1965, and current projections indicate a worldwide market for as many as 8,000 new commuter aircraft by 2000 ($1 billion per year). However, few of the commuter aircraft under development are American, and most of these are derivatives of current-technology aircraft. This has raised questions about a loss of traditional U.S. technology lead and about the competitiveness of U.S. manufacturers, not only in the growing foreign market but also in holding their share of a domestic market worth $5 billion to $10 billion in 1980 dollars.

One possible response to the needs of small communities, commuter airlines, and aircraft manufacturers alike is the Small Transport Aircraft Technology (STAT) program initiated by the National Aeronautics and Space Administration (NASA) in 1978. STAT has identified potential advanced-technology applications in four areas—aerodynamics, propulsion, systems, and structures. Studies by three U.S. manufacturers suggest that commuter aircraft incorporating these potential improvements could significantly reduce fuel consumption and direct operating and production costs.

According to NASA, a dedicated R&D program to bring these technologies to readiness for commercial development would require between 3 and 6 years and cost between $18 million and $135 million. Some airline and aerospace observers feel that such a program would encourage U.S. firms to develop advanced-technology commuter aircraft, but others question whether the results of a NASA program would in fact be used by U.S. firms.

Global Models, World Futures, and Public Policy: A Critique



Global models—computerized mathematical simulations of the world's physical and socioeconomic systems—have been the basis for a number of long-range forecasts of global trends in population growth, resource availability, economic development, and environmental conditions.

These forecasts range from guardedly optimistic to highly pessimistic, but they generally identify the same potential problems and arrive at roughly similar qualitative conclusions about the present state of the world and its plausible futures:

- Population and consumption cannot grow indefinitely without eventually causing widespread hunger and resource scarcities, but there is no physical reason why the basic material needs of all the world's people cannot be met for the foreseeable future. These needs are not now being met because of unequal distribution of resources and consumption, not because of overall physical scarcities.

- While progress is notable in some areas, continuation of many other recent trends would result in growing environmental, economic, and political difficulties; as a result, "business as usual" is not a likely future course. Regional problems of global concern, such as food shortages in South Asia and perhaps Central Africa, are far more likely than a global collapse.
- The next 20 to 30 years will see a transition to a state of the world that is qualitatively different from the present. Technological progress is expected and indeed vital, but the models suggest that social, economic, and political changes will also be necessary.
- Actions taken soon are likely to be more effective and less costly than the same actions taken later, and cooperative long-term approaches are more beneficial for all parties than competitive short-term strategies.
- Many existing plans and agreements—particularly complex, long-term international development programs—are based on assumptions about the world that are mutually inconsistent or inconsistent with physical reality.

In its study, OTA surveyed four major global models and the Global 2000 study conducted by the U.S. Government. The study also examines the Government's use of such models and their potential usefulness in dealing with long-range issues.

Although the accuracy and usefulness of global models are limited by theoretical constraints and by a lack of adequate and reliable data in some areas, global models offer several advantages over traditional techniques of long-range analysis and policy development. As tools for understanding complex interrelationships, they could be useful in four areas: 1) assessing the future impacts of current policies, 2) detecting early signs of potential problems or opportunities, 3) testing a wide range of policy alternatives, and 4) ensuring consistency between agencies and between short- and long-term goals.

OTA found extensive and growing use of models by Federal agencies ranging from the Department of Agriculture to the Joint Chiefs of Staff. Steps toward improving the models could include efforts to expand and standardize data bases and to strengthen communication between model developers and model users in different agencies. Technical advances in methodology and validation are also desirable, but another vital step would be to make modeling a continuing activity that responds to the information needs of decisionmakers.

Use of Models for Water Resources Management, Planning, and Policy

Mathematical models have significantly expanded the Nation's ability to manage and wisely plan the use of its water resources, and promise even greater benefits in the future. However, the rapidly advancing field of water resource modeling has outstripped the capacities of Federal, State, and local agencies to support and effectively use these tools.

As the United States approaches full use of its water resource, the ability to analyze the consequences of water resource development becomes increasingly important and difficult. Mathematical models—most often computerized—are extensively relied on to meet this purpose. They are among the most sophisticated analytic technologies available, despite varying technical capabilities among the many water resource issues. They are significantly improving the accuracy of information on water supplies, floods and droughts, water quality, and the economic and social consequences of water-related development and controls.

Models can substantially reduce the cost of managing water resources. For example, models are used to predict the water quality that would result from proposed wastewater discharge, before costly treatment systems are built. They assist in decisionmaking by providing information for people to interpret in light of existing laws, political and institutional structures, and informed professional and scientific judgment.

Much of the analysis presently performed to assess water resources would not be feasible without current modeling capabilities. Models are also relied on to perform analyses required by many of the major Federal laws, including the Clean Water Act, the Water Resources Planning Act, and Federal flood control legislation.

The Federal Government spends approximately $50 million per year on water-related mathematical models to help plan billions of dollars of annual water resource investments, and help manage hundreds of billions of dollars of existing facilities. Nonetheless, no overall strategy for developing and using models exists within most Federal agencies. Little effort has been made to coordinate the development, use, and dissemination of models throughout the Federal Government, or to assist State and local governments in using these tools. As a result, many legislative requirements and decisionmaker needs for information are not being met. Moreover, many water resource agencies, particularly at State and local levels, are unaware of currently available models that could be applied to their information needs.

Opportunities for congressional action to improve the Nation's water resource analysis capabilities include:

- modifying the mechanisms governing Federal water research to direct adequate resources toward developing research results into usable analytic tools;
- directing individual Federal agencies to provide comprehensive support programs for modeling and other analysis needs, both for their own use and for use at State and local government levels; and
- directing agency resources toward training in the use and interpretation of models, and disseminating information about existing water resources models.

Review of the FAA 1982 National Airspace System Plan

The 1982 National Airspace System (NAS) Plan for modernizing air traffic control (ATC) facilities and equipment is a significant and bold step compared to past Federal Aviation Administration (FAA) efforts to chart a future course for aviation. However, it lacks a clear sense of priorities and provides no contingencies in the event of delays or problems. It proposes improvements in the en route traffic control system, but fails to relate them to the system as a whole and to deal with the principal constraint on the future growth of aviation—airport and terminal area capacity.

REVIEW OF THE
FAA 1982
NATIONAL AIRSPACE
SYSTEM PLAN

Other findings and issues identified in OTA's NAS Plan review are:

- FAA may be overestimating future air traffic growth. These projections underlie the proposed approach to and funding for enroute computer replacement, a decision that sets the pace and direction for overall system modernization.
- FAA's first step in computer replacement—"rehosting" existing ATC software in processors which "emulate" the IBM 9020 computers—runs the risk of freezing future system development. Alternative approaches, such as upgrading the existing computers and beginning immediately to design a complete system of hardware, software, and displays, could take better advantage of advances in computer technology and provide a replacement system within the same time frame. The cost savings could be as high as $186 million.
- The NAS Plan asserts that substantial cost savings will accrue from the planned use of advanced automation but does not provide supporting analysis.
- The proposed long-term ATC system improvements are generally directed to the needs of high-altitude traffic operating under In-

strument Flight Rules. If carried out, they would also benefit FAA itself in the form of manpower savings and reduced operating costs. They do not seem as well suited to the needs of general aviation and of military services.

- Implementing the improvements proposed in the 1982 NAS Plan would more than double FAA's budget for facilities and equipment through 1987, compared to average annual expenditures over the last 10 years. FAA proposes to cover 85 percent of capital investments and about half of operating costs through user fees and a drawdown on the uncommitted Trust Fund balance. The proposed user fee schedule would perpetuate the existing cross-subsidy from airline passengers and shippers of air cargo to general aviation, particularly business aviation. In addition, high user fees may dampen the growth of aviation, thereby reducing projected revenues.

Implications of Electronic Mail and Message Systems for the U.S. Postal Service

Implications of
Electronic Mail and
Message Systems for
the U.S. Postal Service

Commercially offered electronic mail and message systems (EMS) and electronic funds transfer (EFT) systems will increasingly compete with portions of the traditional market of the U.S. Postal Service (USPS). While there is disagreement on how fast EMS and EFT markets may develop, it seems clear that two-thirds or more of the current mailstream could be handled electronically, and that the volume of USPS-delivered mail is likely to peak and then fall below today's level sometime in the 1990's. Any significant decline in the volume of mail would affect future postal rates, service levels, and labor requirements.

A key policy issue requiring congressional attention is how USPS will participate in providing EMS services, both in the near term and in the longer term. A USPS role in the provision of EMS services, especially those which require delivery of hardcopy (Generation II), has the potential to cushion some of the effects of reduction in conventional mail volume and revenue. Since private firms are neither willing nor able to duplicate the nationwide physical delivery structure of USPS, any large-scale Generation II EMS service depends on USPS participation for hardcopy delivery. But beyond this, there is little consensus on exactly what the USPS role should be.

USPS believes its participation in EMS is authorized by the Postal Act mandate to use new facilities and equipment to improve the convenience, efficiency, and cost effectiveness of mail service. However, various telecommunication and computer firms view USPS involvement in EMS as the entry of a Federal agency into competition with private industry, raising difficult questions of ratesetting and possible cross-subsidy. Without congressional action to provide a clear direction for USPS and to clarify or redefine regulatory boundaries, the current controversy over USPS participation in EMS is likely to continue, and opportunities for USPS, as well as for private telecommunication carriers and mailers, may be lost.

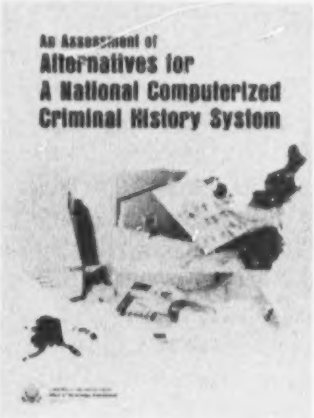
USPS is already involved in Generation II EMS to a limited extent. In January 1982, USPS introduced an electronic computer-originated mail service, known as E-COM, in which USPS accepts letters in electronic form, converts them to hardcopy (including printing and enveloping), and delivers them. A review of E-COM costs and markets is needed in order to determine the USPS role that would be most conducive to growth of Generation II traffic (and hence USPS mail volume) and have the most favorable impact on USPS finances.

Congress may also wish to clarify the applicability of the Private Express Statutes to delivery of Generation II EMS hardcopy; delineate the division of regulatory jurisdiction between the Postal Rate Commission and the Federal Communications Commission; decide on the desirability of a separate USPS entity for any EMS offering; mandate an independent security review to ensure that adequate technical measures are in place to protect the privacy of EMS messages; and consider amending the Postal and/or Communications Acts to provide additional statutory privacy protection for EMS.

For the longer term, Congress will need to maintain oversight and initiate planning on the future viability of USPS, including ways to increase cooperation with the private sector (e.g., joint technical and market tests), possible USPS use of telecommunication or all-electronic Generation III EMS delivery (e.g., in rural and less populated areas) through lease or contract with private firms, use of EMS in combination with the USPS structure to provide other Federal Government services, and the need for adjustments in anticipation of USPS labor force reductions.

Regardless of the USPS role in EMS, improved postal worker productivity combined with eventual declines in conventional mail volume is expected to lead to reductions from the present number of employees. The USPS labor force requirement in 2000 is most likely to be down by at least 20 to 25 percent, with some employee groups (such as mail handlers) declining by 30 to 35 percent. The ability of USPS to handle necessary reductions through attrition and the possible effects on minority employment, upward mobility, employee morale, and union contract negotiations are areas that warrant attention and study.

Alternatives for a National Computerized Criminal History System



An Assessment of
Alternatives for
A National Computerized
Criminal History System

Computer and communication technology has the potential to substantially improve the nationwide exchange of criminal history information, thereby assisting criminal justice decisions (e.g., police investigation and booking, pretrial release and bail, sentencing). However, the debate over a national computerized criminal history (CCH) system has raised difficult questions about the use and quality of information in the system, and management and control of the system itself. Depending on the mechanisms established to control a national CCH system, the quality of the records exchanged, and the standards set for operation and use, the system could have important implications for employment and licensure, Federal-State relationships, and civil and constitutional rights, as well as for public safety and the administration of justice.

Criminal history records are used at all levels of government, by all sectors of the criminal justice community, and increasingly by the noncriminal justice community. There are many ways that a national CCH system could be designed to facilitate exchange of criminal history records. The emerging consensus among Federal and State criminal record repository and law enforcement officials favors the Interstate Identification Index (III) concept. Here, only Federal offender records and an index to State offender records would be maintained at the national level, along with a national fingerprint file on criminal offenders. Most of the building blocks for III are already in place. But without Federal direction in resolving several key issues as well as some modest Federal funding, full implementation of III would probably take many years.

One key issue is how to devise a policy control mechanism that will represent the interests of the law enforcement, prosecutorial, judicial, correctional, public and private defender, and noncriminal justice sectors, as well as Federal, State, and local criminal history record managers and the general public. There are many possibilities, such as a consortium of States, a Federal agency responsible for system management (e.g, the Department of Justice or Federal Bureau of Investigation (FBI)), an advisory policy board to that agency, and/or an independent board.

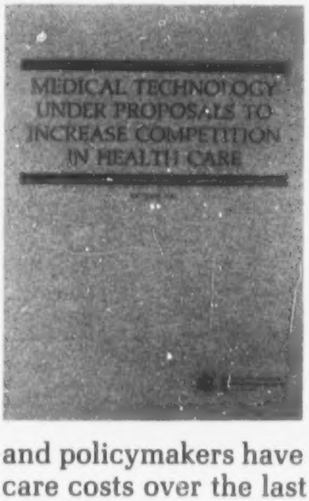
Since 1970, Congress has expressed concern about the completeness and accuracy of criminal history records. OTA found that record quality has improved, but significant problems remain, especially with respect to court disposition reporting. On the average, about one-third of court dispositions are not being reported to State criminal record repositories, although individual States vary widely. Congress may wish to strengthen current reporting requirements and/or fund efforts to improve record quality.

Congress also has expressed concern about noncriminal use of criminal history records (for employment and licensing and security checks). Such use is permitted under many State and Federal statutes. But the definitions of authorized users and policies on record dissemination vary widely among jurisdictions. This reflects in part considerable disagreement over the value of criminal history records for noncriminal justice purposes—especially arrest records without court disposition or conviction information. Congress could entirely prohibit noncriminal justice access to a national CCH system, permit such access only to records with disposition or conviction information, or resolve existing conflicts between and among State and Federal laws but otherwise maintain the status quo.

Congress may wish to review the size and content of any national index or file, establish new oversight and audit procedures to help ensure compliance with system standards, and provide modest Federal funding to improve court disposition reporting and facilitate III implementation. Congress also could determine whether a Department of Justice or FBI role in the electronic interstate exchange of criminal history records and inquiries (i.e., message switching) should be authorized, request the preparation of alternative plans for the consolidation of Federal criminal history functions, and consider the need for legislation on a national CCH system.

Medical Technology Under Proposals To Increase Competition in Health Care

Greater competition in health care is intended to increase the cost consciousness of physicians, hospitals, and patients, which, in turn, could lower hospitalization rates and promote the use of less expensive medical technologies. However, an analysis of two major strategies to increase competition raises concerns about the resulting quality of care. Both strategies would also intensify the need for information on benefits and costs of decisions consumers would have to make about when to seek care, what kind of care to seek, and which health plan to choose.



MEDICAL TECHNOLOGY
UNDER PROPOSALS TO
INCREASE COMPETITION
IN HEALTH CARE

The term "medical technology" includes drugs, devices, medical and surgical procedures, and the organizational systems involved in providing health care. Economists and policymakers have attributed the dramatic upward spiral in health care costs over the last 15 years to the lack of competition, or lack of sensitivity to price, on the part of those who buy and use medical technology.

Two strategies to promote price competition are: 1) to require that patients pay a larger share of their medical bills ("cost sharing"), and 2) to create greater competition among organizations providing health insurance and delivering comprehensive medical care. A change in tax policy—making it more neutral toward medical insurance coverage—is a key element of both approaches. Both would also cover comprehensive care and catastrophic medical expenses, and subsidize premiums or costs according to income levels.

Some of OTA's findings in regard to greater patient cost sharing are as follows:

- Higher direct costs would discourage people from seeking medical care and would lead those who did to use fewer and less expensive services. As a result, physicians might choose less costly technologies and settings, such as outpatient care instead of hospitalization.
- There would probably be little effect on the use of preventive technologies, because present insurance often excludes them from coverage. Important exceptions are children in low-income families, who have historically made less use of preventive technologies when paying a greater share of medical costs.
- The effect on technology use and cost of coverage for catastrophic medical expenses is unclear; fewer cases would reach the catastrophic limit, but those that did might be treated more intensively.
- Physicians and hospitals would continue to have an incentive to overuse technology because they would continue to receive more revenue from its greater use. Overuse of technologies such as hospitalization could cause the quality of medical care to suffer, as often happens under present systems.

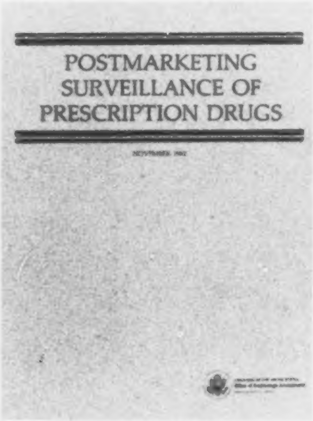
The other proposal—to increase competition among comprehensive care organizations—relies on the organizations that deliver care to control technology use and cost as they compete for enrollees. Major findings for this approach are:

- With lower cost sharing for outpatient care that is common in prepaid groups, cost would not discourage people from seeking care as much as the option to increase cost sharing would. Hospitalization rates, especially for surgery, would fall for all age groups and income levels. Changes would be expected in the innovation and use of managerial technologies in staffing patterns, the delivery of outpatient care, and alternative delivery systems.
- Organizations would control technology use for catastrophic care as prepaid groups do now. They would not necessarily provide more immunizations or counseling.
- There would be a concern about less than adequate quality of care, because physicians and hospitals would have financial incentives to limit costs, even at the expense of quality.

Strategies to increase competition would not eliminate regulation. Although greater dependence would be placed on individuals to decide about the value and use of technologies, regulation would be needed to establish an environment in which the buyers and users of medical technology would be sensitive to price. Specific areas of policy interest are Government's role in consumers' selection of plans, quality assessment and assurance, consumer information, and regional distribution of technologies.

Postmarketing Surveillance of Prescription Drugs

This OTA report describes the drug approval process, the history and objectives of postmarketing surveillance activities, the methods used in premarket and postmarket testing, and current activities in postmarketing monitoring. It then provides legislative options, including ways to strengthen authority of the U.S. Food and Drug Administration (FDA) in postmarket evaluations of prescription drugs.



POSTMARKETING
SURVEILLANCE OF
PRESCRIPTION DRUGS

The premarketing approval process is now the primary method for assessing the safety and efficacy of prescription drugs. However, the premarketing tests are not capable of detecting some adverse effects that may occur only after months or even years of use of a drug. Therefore, over the last decade, postmarketing surveillance activities have been proposed to monitor drug usage mainly to determine more completely a drug's beneficial and harmful potentials.

Current interest in prescription drug evaluation and monitoring is focused on the premarketing approval process and the length of time it takes for a drug to be approved by FDA. This interest is reflected in: 1) bills before Congress to extend the patent life of drugs and other federally regulated products by the amount of time it takes for such products to clear the premarket approval process; 2) establishment of a recent Congressional Commission on the Federal Drug Approval Process; and 3) proposals to improve and speed-up the drug approval process. However, postmarketing surveillance of drugs is also a critical policy issue.

The issue of postmarketing surveillance of the effects of drugs has been spotlighted only periodically. In August 1982, Eli Lilly & Co. withdrew its new arthritis drug, Oraflex®, after it was banned in Great Britain pending further investigation of evidence linking the drug to adverse effects, including deaths. The drug had been available in Great Britain for 2 years but available in the United States for only 3 months. A similar withdrawal occurred in January 1980, when Smith Kline & French withdrew its high blood pressure drug, Selacryn®, following reports of liver damage and deaths. While FDA has the authority to ban a drug immediately as an "imminent hazard to the public health," this power has been used only once—in 1977, when FDA banned Phenformin®, a diabetes drug.

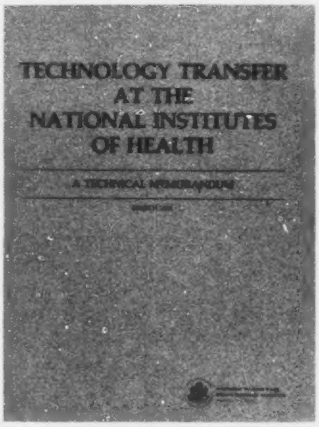
Legislative options that could strengthen FDA's powers in the postmarketing period include: 1) giving FDA the power to require postmarketing studies; 2) giving FDA the power to restrict the distributing, dispensing, and administering of a drug; and 3) changing the standard for a drug's immediate removal from the market from "imminent hazard to the public health" to "unreasonable risk of illness to any segment of the population" or some other less stringent standard. These options could be pursued independently of any revisions in the premarketing approval process.

The OTA report also provides guidelines for determining whether various possible changes in the drug approval process would affect its current capability to detect adverse drug reactions prior to a drug's release for marketing.

TECHNICAL MEMORANDUMS AND BACKGROUND PAPERS

Technology Transfer at the National Institutes of Health (Technical Memorandum)

This Technical Memorandum examines the current technology transfer and assessment activities of the National Institutes of Health (NIH).



TECHNOLOGY TRANSFER
AT THE
NATIONAL INSTITUTES
OF HEALTH

A TECHNICAL MEMORANDUM

The timely transfer of medical technologies from the research setting to medical practice has important implications for the quality and cost of health care. The Institutes of NIH are responsible for much of the basic science knowledge that exists and for a large share of the evaluation of medical technologies that takes place.

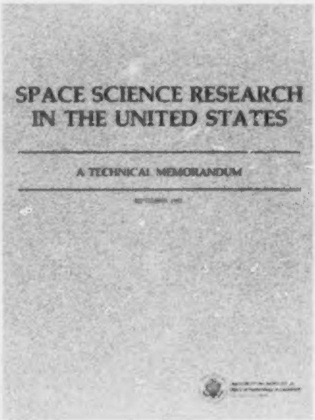
The report presents general information on how biomedical research leads to the development of medical technologies and how those technologies are evaluated for their benefits and risks and then transferred into the health care system. The current state of NIH activities related to developing, evaluating, and transferring techologies is described. The report also contains detailed examinations of two NIH Institutes—the National Cancer Institute and the National Heart, Lung, and Blood Institute—because of their size, importance, and the extent of their involvement in the transfer of medical technologies.

OTA's findings apply to medical technology transfer in general, and are not confined to NIH. NIH was examined because it is one of the most crucial participants in such evaluation and transfer.

The main findings are that, despite some difficulties in the timely transfer of technologies, the most critical problems are: 1) inadequate attention as to whether technologies being considered for transfer rest upon a sufficient knowledge base; and 2) insufficient evaluation of the potential benefits and risks of medical technologies prior to their transfer.

The report concludes that NIH's current methods for transferring technology are appropriate. The agency disseminates information on new technologies and funds demonstrations of their potential uses. However, when information on the benefits and risks of technologies to be transferred is inadequate, these processes cannot operate properly. Thus, if NIH's activities that provide such information—clinical trials and consensus activities are the major examples—are to be fully effective, additional funding may be required.

Space Science Research in the United States
(Technical Memorandum)



SPACE SCIENCE RESEARCH
IN THE UNITED STATES

A TECHNICAL MEMORANDUM

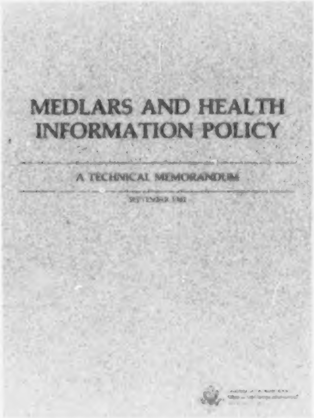
In the view of many scientists, space science is in a state of crisis. The future of several subdisciplines (e.g., solar and heliospheric physics, and X-ray and gamma ray astronomy) as well as the disciplinary area of planetary science is uncertain because of recent and proposed budget cuts. Several major missions have been indefinitely postponed, and funding for important interim activities such as data analysis from previous missions is inadequate.

Unlike the manned space program, space science has never been directed toward a particular national goal of unequivocal priority. As a result, space science policy has been conducted in a mode where the programs undertaken are determined primarily by available budget and only secondarily by scientific goals. Furthermore, no base budget has ever been set to ensure that certain scientifically critical activities are sustained.

The current practice of budgeting most flight missions as independent new starts emphasizes spectacular accomplishments, and is not necessarily optimal for scientific progress. With a view to implementing a more programmatic approach, it might be advisable to develop an alternative budgeting strategy, in which budgets are separately established for important continuing activities (including instrument design, data analysis, theory, and perhaps small- to moderate-sized missions) and for major missions (including hardware, launch, and operations). In this way, activity that is scientific per se might be better protected from cost overruns, whether in the high-priority manned program or in large science missions.

International cooperation in space science activities has been fruitful in the past and, for possible major missions in the future, may be highly desirable in order to share costs. There has been, however, a continuing problem of the United States' changing its commitments to international missions. Potential foreign partners are therefore reluctant to enter future agreements with the United States.

MEDLARS and Health Information Policy
(Technical Memorandum)



MEDLARS AND HEALTH
INFORMATION POLICY

A TECHNICAL MEMORANDUM

This Technical Memorandum examines the relationship between the National Library of Medicine (NLM) and the private sector in creating and distributing health-related information by means of computerized bibliographic retrieval systems. The study also examines the effectiveness of NLM's computerized system MEDLARS (Medical Literature Analysis and Retrieval System) in distributing health information.

The National Library of Medicine is the Nation's principal resource for the collection, organization, and retrieval of scientific literature in the health and biomedical fields. MEDLARS is a complex system that maintains data files, provides on-line retrieval services, and produces computer-photocomposed publications. MEDLINE (MEDLARS on-line) is the largest and most extensively used of NLM's data bases.

In its analysis of the effectiveness of MEDLARS in distributing bibliographic information, OTA examined three issues: 1) the subject content of the literature cited in the MEDLARS data bases, especially MEDLINE; 2) the coverage of nonjournal literature in the MEDLARS data bases, particularly MEDLINE; and 3) an evaluation of the methodological design of articles in literature cited in the MEDLARS data bases. OTA's conclusion is that MEDLARS, in general, is effective in distributing health information. Yet, there are technical limits to the system that prevent MEDLARS from satisfying the needs of all its users.

OTA's examination of the relationship between NLM and the private information sector focuses primarily on the issues related to leasing NLM's data base tapes and the charges for on-line access to its data bases. Some argue that MEDLARS' subsidized prices give NLM a competitive advantage, and that NLM should recover the "full costs" of its products and services. At the same time, others claim that its low cost aids in the dissemination of health information to all who seek it. The debate is further complicated by the fact that "full cost recovery" has many different interpretations.

The study concludes that the creation of MEDLINE by the Library seems warranted by NLM's extensive collection of biomedical materials, by its legislative mandate, and on economic grounds. It is uncertain taht if NLM were to stop creating MEDLINE that a new or established private firm would produce a similare product. OTA also concludes that there is no compelling reason for NLM either to continue or to discontinue providing on-line access to MEDLINE, as opposed to access through private information services that lease the MEDLINE data tape.

In drawing the proper balance between the public and private sectors, OTA finds that there are insufficient data to decide, on purely technical grounds, the most efficient and effective combination of public and private computerized health-related bibliographic activities. Arguments presented by proponents or opponents seem to reflect philosophical perspectives rather than objective analysis.

OTA also finds that rapid advances in the computer and communications fields may, in the near future, profoundly alter the issues and change the effects of current decisions on information policies and practices.

Air Cargo
(Background Paper)

This study is one of four parts of an OTA assessment of the economic, environmental, and societal impacts of advances in the technology of transport aircraft. It focuses on the principal factors that could influence the future evolution of air cargo transport.

IMPACT OF ADVANCED
AIR TRANSPORT
TECHNOLOGY
Part 2 - The Air Cargo System
Background Paper

Revenues from the air cargo industry exceeded $3 billion in 1980. However, air cargo is still dwarfed by the passenger side of the airline business and the surface transport side of goods movement. It totals only 11 percent of all U.S. airline revenues and 1.4 percent of all domestic freight revenues. Growth has been steady and well above the gross national product growth, according to the OTA paper.

Today, almost all civil cargo aircraft are derivatives of passenger aircraft. Current estimates of future market prospects (7 to 12 percent annual growth) do not indicate that this situation will change appreciably in this century. While a dedicated cargo carrier using 1990's technology might cut fuel consumption by as much as 50 percent compared to today's most efficient carriers, very nearly the same gains in efficiency could be achieved through conversion of 1990's passenger aircraft for cargo use.

The Department of Defense is studying several options for meeting its future airlift needs, including the design of a joint civil/military cargo aircraft. However, industry remains skeptical that the product of such a joint planning effort would be competitive with derivatives of future passenger aircraft.

More efficient handling of cargo on the ground could have as much impact on future growth and profitability of air cargo as would the introduction of more efficient aircraft. It has been estimated that complete containerization of cargo and a high level of mechanized handling could reduce the cost of ground operations by as much as 70 percent.

The air cargo industry is undergoing a period of rapid change brought about in part by deregulation of air cargo in 1977, passenger airlines in 1978, and trucking in 1980. Several carriers are taking advantage of new opportunities under deregulation to offer single-carrier shipping using both air and ground modes of transportation.

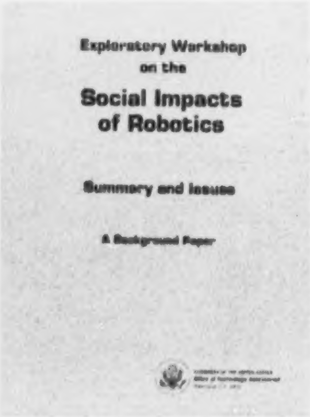
The study points out that express package delivery—using conventional aircraft and ground handling systems—is the fastest growing and most profitable segment of the air cargo industry. This example suggests that while new technology can result in operating efficiencies, it is not a substitute for providing services carefully tailored to the needs of shippers.

OTA found continuing active interest in using lighter-than-air (LTA) or hybrid LTA vehicles as air cargo carriers. However, they are not likely to compete with conventional air and surface modes for the movement of goods over long distances.

The only Federal regulations of major consequence still in place following air cargo deregulation concern aircraft safety and noise standards. Two additional areas for continued Federal involvement relate to unfair foreign practice concerning U.S. carriers and international agreements on ratemaking. One potential problem area relates to the phasing out or elimination by the Civil Aeronautics Board (CAB) of reporting requirements. This has left both the Government and the public with no means of monitoring the flow of the air cargo portion of interstate commerce. The Air Freight Forwarders Association has requested that CAB reestablish some "minimal" reporting requirements to show where freight is moving and where traffic is developing.

Exploratory Workshop on the Social Impacts of Robotics (Background Paper)

OTA sponsored the workshop last summer in response to congressional interest in the rapid advances in computer technology and its applications, and public concern about the economic health of U.S. manufacturing industries.



Exploratory Workshop
on the
Social Impacts
of Robotics
Summary and Issues
A Background Paper

A robot can be defined as "a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices, through variable programed motions for the performance of a variety of tasks."

The paper points out that primary U.S. interest in robotics stems from the belief that robots, along with other new automation technology, will be an important tool for improving the competitiveness of U.S. manufacturing. There is also concern about possible impacts of this technology on workers as it becomes more widely used.

OTA workshop participants—including robotics researchers and representatives from robot manufacturing firms and firms that use robot technology—generally agreed on the following points:

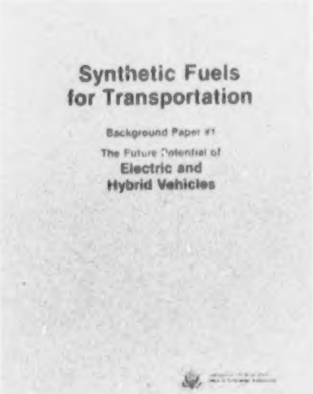
- the use of robots for industrial automation is growing rapidly, with heavy use likely by the end of the decade;
- robotics is only one of several technologies that contribute to the automation of manufacturing;

- any major impacts of robotics on productivity and employment within this decade will be attributable to the general trend toward computerized automation, computer-aided design, the use of information systems to control operations and support managements, and the integration of all these technologies into flexible manufacturing systems;
- robots, specifically, may have important longrun impacts as the technology develops toward computer-based mobile devices that can perform a variety of complex tasks and thereby substantially broaden the range of their potential use.

The workshop identified a number of issues concerning the robot industry relating to industrial organization, research and development, government use, definition and standards. Also identified were a number of social and economic issues which OTA groups into five sets: productivity and capital formation; labor; education and training; international competition and trade; and potential future applications of robots for defense, space exploration, and ocean mining.

The Future Potential of Electric and Hybrid Vehicles (Background Paper)

This is a Background Paper for the OTA report titled "Increased Automobile Fuel Efficiency and Synthetic Fuels: Alternatives for Reducing Oil Imports."



Synthetic Fuels
for Transportation

Background Paper #1

The Future Potential of
Electric and
Hybrid Vehicles

The report presents a comprehensive review of the future of electric and hybrid vehicles through the year 2010 in the United States. It discusses the technology, performance, and limitations of probable future electric and hybrid vehicles; the infrastructure necessary to produce and support them; marketability; and finally, effects on the Nation if used in large numbers.

The paper discusses the technology of electric vehicles, and what it may offer in the future. The technology of hybrid vehicles is also discussed because hybrids are an extension of electric vehicle technology which will probably reach the marketplace only after the appearance of electric vehicles, and only if satisfactory storage batteries and electric drive trains have been developed.

The paper considers the infrastructure required to support electrified travel. The principal elements of the infrastructure are the electric power system, which must recharge batteries; the materials industry, which must supply large quantities of materials used in batteries; and the automobile industry, which must both produce and maintain electric vehicles.

Marketability of electric and hybrid vehicles is reviewed. The critical role of the cost and availability of liquid fuels for heat engine vehicles is examined along with the possible effect of incentives for electric and hybrid vehicles which may be provided by governmental action.

The study concludes with a review of the benefits and costs, monetary and nonmonetary, which might accrue if electric and hybrid vehicles were to be widely used in the United States.

Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity (Background Paper)

This paper focuses primarily on user privacy, system security, and consumer equity, and briefly discusses other questions and issues related to electronic funds transfer (EFT). Relevant EFT developments since the completion of the work of the National Commission on Electronic Funds Transfer are considered.

Selected Electronic Funds Transfer Issues

Privacy, Security, and Equity

Background Paper

The paper is one of four components of the OTA assessment of Societal Impacts of National Information systems. An OTA report released last fall, "Computer-Based National Information Systems: Technology and Public Policy Issues," provides a comprehensive overview of the assessment.

EFT includes a cluster of technologies that allow financial transactions to be made electronically rather than by the use of cash or checks. Examples are automated teller machines (ATMs) and telephone bill payment. The term EFT is also used to refer to the electronic transfer of information critical to financial transactions, such as credit authorization and check validation.

Although most EFT technologies are no more than 15 years old, they are already having a significant impact on payment systems, banks, and other financial institutions. Within the next two decades, it is possible that EFT will transform the way Americans carry out their day-to-day commercial activities and personal monetary transactions, according to OTA.

In addition to the financial institutions that have traditionally provided payment services (commercial banks, savings and loan institutions, mutual savings banks, and credit unions), the key actors in the development of EFT are Government institutions such as the Federal Reserve, the U.S. Treasury, and regulators of financial institutions, as well as retail stores and employers.

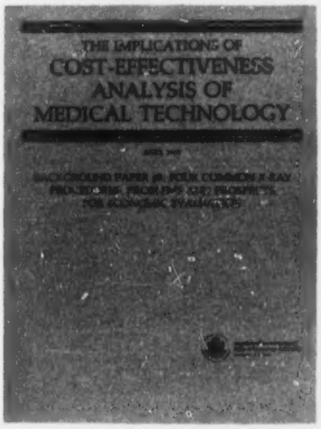
EFT, in common with other national information systems, raises new issues of privacy, security, and equity. In general, greater concern is expressed about privacy in EFT that in older more familiar systems. The OTA paper examines these concerns and also looks at the ways in which EFT can enhance the privacy of financial transactions. The recommendations on privacy made by the National Commission on Electronic Funds Transfer in 1977 are compared with the present status of existing and proposed legislation.

Any payment system or financial institution must be able to guarantee, at least to some reasonable degree, the safety of assets entrusted to it. The security implications of EFT systems are discussed by OTA. Although the average loss per theft appears to be greater in EFT systems than in paper-based systems, there is no evidence that EFT systems to date have experienced a crime rate that is higher than average. They do, however, have some vulnerabilities that are different from paper-based systems. Financial institutions are generally reluctant to call attention to EFT security problems or to encourage public discussion. As a result, there is a paucity of information about EFT security.

In modern society, the ability to carry out basic financial transactions is essential. EFT offers benefits in terms of customer convenience and reduced costs, as well as increased productivity for financial institutions. However, to the extent that some forms of participation in EFT become mandatory or inescapable, or to the extent that EFT significantly displaces or raises the costs of alternatives, some groups could experience a loss of equity of access to financial services.

The Implications of Cost-Effectiveness Analysis of Medical Technology (Background Paper)

Analyzes the feasibility, implications, and usefulness of cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA) in health care decisionmaking, including the current and potential use of CEA/CBA or related techniques in six health care activities: reimbursement programs, Professional Standards Review Organizations, health planning market approval for drugs and medical devices, research and development programs, and health maintenance organizations.


THE IMPLICATIONS OF
COST-EFFECTIVENESS
ANALYSIS OF
MEDICAL TECHNOLOGY

In addition to the main report (published in August 1980), there are five background papers: 1) *Methodological Issues and Literature Review*, published September 1980; 2) *Case Studies of Medical Technologies*, consisting of 17 individual case studies, 15 were pubished in 1981. The final two case studies (listed below) were published in 1982; 3) *The Efficacy and Cost Effectiveness of Psychotherapy*, published October 1980; 4) *The Management of Health Care Technology* *in Ten Countries,* published October 1980; and 5) *Assessment of Four Common X-Ray Procedures,* published in 1982.

Case Study 9: The Artificial Heart: Cost, Risks, and Benefits.—Discusses the potential societal benefits, costs, and risks of continued investment in the artificial heart. Provides an opportunity to address policy questions concerning the distribution of research funds for treating heart disease, the equitable distribution of medical technology, and the potential costs to society before this life-saving technology is available for therapeutic use.

Case Study 13: Cardiac Radionuclide Imaging and Cost Effectiveness.—Examines the rapidly expanding diagnostic technology of cardiac radionuclide imaging used for the diagnosis and management of heart disease. Discusses the market and the industry, users and uses, costs and charges, clinical efficacy, analyzes cost effectiveness, and policy implications for this new technology.

Background Paper #5: Four Common X-Ray Procedures: Problems and Prospects for Economic Evaluation.—The medical profession has recently been debating the appropriate use of X-ray procedures, and whether the benefits are worth the risks and costs. This paper reviews the problems and prospects for economic evaluations of four common X-ray procedures, which together constituted almost half of all diagnostic X-ray procedures performed in the United States in 1970. These procedures are chest X-ray, skull X-ray, barium enema study, and excretory urogram. The paper discusses the influence evaluations have had on the use of each of the procedures, and how evaluative research might increase its impact on medical decisionmaking.

Financing and Program Alternatives for Advanced High-Speed Aircraft
(Background Paper)

This paper identifies and examines the potential financial and managerial barriers to carrying out a large-scale program to create a long-range commercial air transport using new technology.

IMPACT OF ADVANCED AIR TRANSPORT TECHNOLOGY

Part IV Financing and Program Alternatives for Advanced High Speed Aircraft

The study looks at the technological, market, and financial risks of such a program and the ability of the U.S. aerospace industry to assume them.

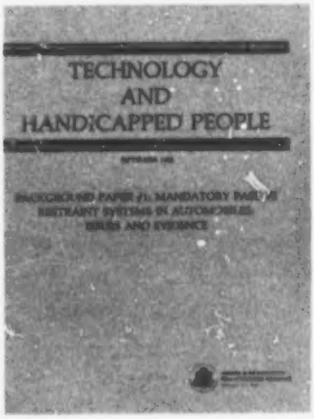
Among the issues associated with the development of advanced technology commercial air transport programs are:

- the structure of the aerospace industry and the attributes of aircraft markets;
- the financial capacity of the aerospace industry; and
- the appropriateness and the potential level of Federal involvement in the aerospace research and development.

OTA also describes alternative strategies for implementing advanced air transport projects.

The paper is the fourth and final publication of a broad assessment of new aircraft technologies. Specifically, it supplements the earlier OTA report, *Impacts of Advanced Air Transport Technology: Part I—Advanced High-Speed Aircraft,* requested by the House Committee on Science and Technology. In addition to covering advanced technology aircraft (subsonic and supersonic), the overall assessment includes those aircraft used in providing service to small communities and in transporting air cargo.

Mandatory Passive Restraint Systems in Automobiles: Issues and Evidence
(Background Paper)



TECHNOLOGY
AND
HANDICAPPED PEOPLE

The automobile serves as a prime example of the complexity of modern technology's role in health. Its invention introduced an era in which the time distance between a health crisis and curative medical care would be reduced by critical minutes, in which timely rescue from a burning building would become increasingly feasible, and in which distribution of life-sustaining food and medicine would occur ever more rapidly and inexpensively. Accompanying these health benefits of motor vehicles, however, have been the significant health costs of street and highway travel, and the deaths and injuries which reflect the size, structure, and velocity of the vehicles, as well as characteristics of the roads and of the operators of the vehicles. The disproportionate impact of motor vehicle accidents on the young is particularly tragic, as thousands of lives are cut short in their prime and healthy bodies are committed to decades in beds and wheelchairs. The economic costs of treatment and rehabilitation as well as lost future productivity are substantial. The emotional toll is enormous. It is toward reducing these burdens that the technology of passive restraints is directed.

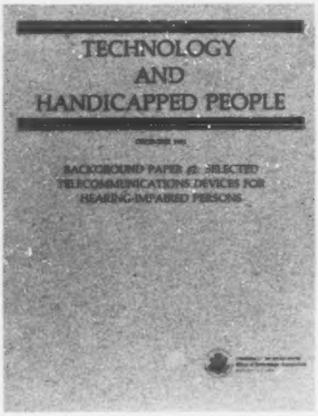
This paper examines issues in the debate on whether passive restraint systems—air bags and automatic belts—should be required in all new automobiles sold in the United States. In 1977, Federal Motor Vehicle Safety Standard (FMVSS) 208, as amended, decreed that all new cars would have to have a passive restraint system capable of meeting a 30-mph crash performance requirement by September 1, 1983 (1984 model year), with phase-in beginning with the largest 1982 model cars by September 1, 1981.

On April 9, 1981, the National Highway Traffic Safety Administration announced a delay of 1 year in implementation of FMVSS 208, and new hearings were held in August 1981 to consider whether the (delayed) rule should be put into effect or one of three alternatives should be adopted. Two of the alternatives involved a reordering of implementation dates for the various sizes of cars; the third involved elimination of the passive restraint requirement.

This is background paper #1 of OTA's report on "Technology and Handicapped People."

Selected Telecommunications Devices for Hearing-Impaired Persons (Background Paper)

This study provides background information on the hearing-impaired population in the United States, and reviews the history and development of technoogies, particularly teletypewriters, to aid hearing-impaired people. The paper also discusses the issues surrounding the use of such technologies, including cost, distribution, and Federal support of the industry's growth.



TECHNOLOGY
AND
HANDICAPPED PEOPLE

BACKGROUND PAPER #2: SELECTED
TELECOMMUNICATIONS DEVICES FOR
HEARING-IMPAIRED PERSONS

This is background paper #2 of OTA's report on "Technology and Handicapped People."

Section III.—Work in Progress

OTA's work is structured along three broad divisional lines: energy, materials, and international security; health and life sciences; and science, information, and natural resources. Within those broad divisions, OTA conducts studies in energy; international security and commerce; materials; biological applications; food and renewable resources; health; communication and information technologies; oceans and environment; and space, transportation, and innovation.

More than 50 projects were in progress during the year, including 16 new studies.

In this section, the broad concerns and current work schedule of each OTA division are described for 1983 and beyond.

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY

The Future of Conventional Nuclear Power

The nuclear reactor manufacturing industry is facing a period of extreme uncertainty. There have been no reactor orders since 1978, and it is quite possible that none will be placed in time to keep existing design and manufacturing capabilities intact. The principal reason has been the decline in electricity demand growth, which has greatly reduced the near-term need for new generating capacity. Other factors and perceptions about nuclear power—e.g., safety concerns, costs, reliability questions—have also contributed to the industry's difficulties. In order for the nuclear option to be available, and be acceptable to the utilities, regulators, and the public, substantial technical and institutional changes may be needed.

This assessment will examine the major technical considerations about the future of conventional nuclear power and how these technologies can affect economic, regulatory, and institutional (e.g., Government and industry responsibilities) issues that govern that option.

Technical issues to be studied include potential improvements to existing reactors such as higher fuel burn up and increased reliability; reoptimized and standardized light water reactors; and different reactor types such as HTGR or CANDU reactors. The consequences of these possible changes on licensing, reactor costs, safety, industrial structure, and public perception will be examined.

Industrial Energy Use

This project examines the four most intensive U.S. industries (pulp and paper, steel, petroleum refining, and organic chemical production) for their potential to use energy more efficiently and the probable impact of selected legislative options on energy use and efficiency.

OTA will examine the available technologies designed to improve energy efficiency, as well as the barriers to the implementation of such technologies. The legislative options to be examined range from tax policy changes such as accelerated depreciation to institutional changes in capital financing methods. Each option's effects will be evaluated through a series of case studies in which corporation executives, consultants, and computer-modeling techniques are used to project the effects of possible congressional action. Options will also be examined at the industry, industrial sector, and national energy use and economic levels using a similar series of modeling, management, and consultant evaluations.

Industrial and Commercial Cogeneration

The need to reduce U.S. dependence on expensive and scarce petroleum as a primary fuel in the industrial, commercial, and electric utility sectors has created a resurgence of interest in cogeneration—the combined production of both electric power and heat or steam in one technological process. Because the total amount of fuel needed to produce both power and heat/steam in a cogenerator is less than the total fuel needed to produce the same amount of power and heat/steam in separate technologies (e.g., a powerplant and an industrial boiler), cogenerators can contribute to the Nation's efforts to use fuel more efficiently. Moreover, problems faced by the electric utility industry, including rapidly rising capital costs, long leadtimes for powerplant construction, and difficulties in finding suitable sites, may make cogenerators an attractive alternative to conventional central station powerplants. This assessment will examine the role that cogenerators could play in providing electric and thermal energy for industrial and commercial facilities while distributing electricity to the utility grid. It will review the economic, environmental, social, and institutional consequences of cogeneration, with a special emphasis on the potential effects on the electric utility industry's planning and operations. Finally, the study will analyze policy options that Congress may wish to consider in addressing the issues about the development of cogeneration systems.

The assessment will examine the technical features of commercial and advanced cogeneration technologies, including requirements for connecting cogenerators to the utility grid and technologies for storing thermal or electrical energy. It will then evaluate the economic and technical effects of grid-connected cogeneration systems on electric utilities using a computer model that minimizes the costs of providing electric and thermal power. A major focus of this evaluation will be the potential effects of oil- and gas-fired cogenerators on overall oil/gas use. Finally, a series of issues on the incentives for cogeneration in the industrial and commercial sectors, and on the economic, environmental, and social effects of cogeneration will be examined.

Strategic Responses to an Extended Oil Disruption

Over the next decade, there is the possibility that the Nation will experience a disruption in imported oil of a level that will exceed the capabilities of the Strategic Petroleum Reserve and seriously affect the economy.

This assessment examines the opportunities and problems that characterize various technical responses that could supplement the Strategic Petroleum Reserve to meet such an interruption. The objective will be to determine what available resources might be expanded, the technical limitations for fuel substitution and switching, the physical constraints of stockpiling resources, and the impacts of accelerating the use of these technologies. Technologies to be considered will include enhanced oil recovery; adapting industrial boilers to dual-fuel capacity; biomass production; high-voltage transmission; hydro; wind; direct solar; vehicle retrofits; photovoltaics; retrofitting building envelopes and heating/cooling systems; retrofitting vehicles to improve mileage efficiency; and switching capacity of petroleum refineries. The study will be done at national and regional levels.

Potential U.S. Natural Gas Availability

In the past few years there has been a change in the outlook about the potential for natural gas production in the lower 48 States. Recent optimistic projections by some groups have stimulated efforts to revise current natural gas policy so that natural gas can play a bigger role in reducing this country's oil imports. There remains, however, considerable uncertainty about how much the United States can rely on natural gas, which is tempering this optimism. This assessment is designed to help determine domestic (lower 48 States) onshore natural gas availability over the next few decades, and to help understand the factors that affect this availability. The OTA assessment will:

1. analyze the key technical and physical parameters that determine the resource base, production rates, and costs of all categories of below-ground natural gas;
2. critically review current estimates of the resource base, estimate the potential production rates of natural gas, and analyze the uncertainties in these estimates;
3. assess future technology trends, research and development needs that may accelerate these trends; and
4. analyze the institutional and policy issues appropriate for a Federal role in dealing with barriers to production.

Technologies To Reduce U.S. Materials Import Vulnerability

The United States currently imports over one-half of its consumption for each of a number of commonly used materials. Included among those imported are several considered to be vital for national defense and the U.S. industrial economy. Several of the most important defense-related materials have only a small number of supplier countries, and these are largely southern African nations, other developing countries, and the U.S.S.R. Raw material supplies are not the only strategic concern. For example, because of the changing world economy, the United States has lost a considerable portion of its capacity to produce ferromanganese and ferrochrome to foreign competition.

The focus of the study will be on technical opportunities to reduce U.S. vulnerability to interruptions in supply of strategic and critical imported materials in the longer term (5 to 25 years) through, for example, substitution, including materials; process and product substitution; improved mining, processing, and recycling technologies; and more efficient fabrication and design.

The study will also identify major changes in materials vulnerability that are likely to occur over the next 25 years because of advances in such fields as electronics, energy, and transportation.

Nonnuclear Industrial Hazardous Waste

Many nonnuclear industrial hazardous waste must be stored or disposed of with great care or they may constitute a threat to health and the environment. Information on the nature and magnitude of the hazardous waste disposal and abandoned site problem will be reviewed. The reliability and efficacy of present containment, abatement, and disposal measures will be assessed. This information, coupled with criteria and techniques to judge relative health and environmental hazards of a given waste, will assist in identifying those wastes that could be reduced at the source—by modifications in process technologies, by recycle, or by an end-use substitution. Approaches for reducing hazardous waste generation with minimal undesirable economic effects on domestic industry will be identified.

This assessment has four objectives: 1) to assess criteria for defining hazardous waste and for judging the relative health and environmental hazards of a given waste; 2) to evaluate technologies for cleaning up present waste disposal sites that are hazardous to health and the environment; 3) to assess technologies and approaches for the safe storage or disposal of hazardous waste being presently generated; and 4) to assess technologies and approaches for reducing the volume of hazardous waste. The possible economic impacts on domestic industry of various approaches will be evaluated.

The project will focus initially on understanding the adverse consequences of present disposal strategies and techniques, and next on ways of reducing generation of industrial hazardous waste economically. Alternative options will be developed to cope with hazardous waste disposal in the short run and hazardous waste generation in the long run.

Wood: The Material, The Resource

The United States has 483 million acres of commercial forestland: 14 billion cubic feet of timber were harvested in 1976. However, the United States still imports nearly 30 percent of its softwood lumber, approximately half of the wood pulp, and significant quantities of plywood. The forest industry and Government experts state that with new technologies for improved forestry practices, better wood utilization, and new product development the United States could become at least independent of wood imports and possibly a net exporter of wood. If domestic wood production is to be increased significantly, policies will be needed to: 1) improve the management of timberlands; 2) resolve conflicts among the users of Federal public lands; and 3) investigate new uses and applications of wood materials. New technologies for the use of wood, which is a renewable resource, may also hold promise as substitutes for nonrenewable energy and materials resources in some applications.

This assessment has six objectives:

1. explore the properties, uses, and technologies for using wood as a material and its potential for substituting for nonrenewable materials;
2. assess the future demand and supply profiles of wood and identify future problems;
3. evaluate the capability of forest management technology to increase production;
4. analyze the forest management policies on forestlands in reference to wood production and other forest uses;
5. assess the national technology for wood and forestry R&D; and
6. review public policies that affect forest production and the use of wood as a material and identify policy options for dealing with future problems.

Technology Transfer to the Middle East

During the last decade, the Middle East has been the world's fastest growing market, one which West European, Asian, and Communist as well as U.S. enterprises have all sought to penetrate. The oil-rich nations of the region have the financial resources to purchase the most advanced equipment and technology, both civilian and military. Technology transfers on such a large scale may have important implications for both the recipient and supplier nations. However, there has been little systematic study of the extent or effectiveness of transfers of Western technology. OTA's assessment of the commercial and strategic ramifications of transfers of advanced Western technologies (in sectors such as operation and maintenance of aircraft, petrochemical production facilities, nuclear powerplants, communications, and service systems) will help to provide a foundation for U.S. policy development.

The objectives of OTA's study are to assess past experience with technology transfers to the Middle East, to investigate the capability of these nations to effectively absorb advanced Western technology, to evaluate the likelihood of continued and expanding transfers in the years ahead, and to discuss the implications for American foreign and international economic policy.

The following questions will be addressed:

- How extensive have transfers of advanced Western technology to the Middle East been in recent years, what factors have determined which nations supply which technologies, and through what channels has transfer occurred?
- What factors inhibit or enhance the ability of Middle Eastern nations to absorb and master Western technology? Has it been the case that transfers in certain technology sectors have been par-

ticularly "successful," or that the experience of various recipient nations differ significantly?

- How effectively have U.S. firms transferred technology and competed with Asian and West European firms for sales?
- What have been the effects—economic, social, and political—of advanced technology transfers on both recipients and suppliers?

In some sectors, such as petrochemical production, technology transfers augur shifts in world markets; while in other sectors, such as medical services, they promise improvements in local living conditions. Nuclear technology transfers, in contrast, raise critical strategic questions. This study will evaluate the opportunities and liabilities which advanced technology transfers portend for U.S. foreign and commercial policy in the years ahead.

Impact of Technology on Competitiveness of U.S. Electronics Industry

There is a growing concern that key U.S. industries are declining in their international competitive positions. The electronics industry is particularly significant because it occupies a strategic position as a technological driving force for other industries that use products like semiconductors and computers. The OTA assessment looks at three sectors of this industry: consumer electronics (where the United States has suffered heavily from Japanese competition); semiconductors (where a strong U.S. position is under challenge); and computers (where the United States still appears to lead the world).

The assessment focuses on those major contributors to the competitiveness of the electronics industry that could most readily be affected by U.S. Government policy. In each case, a comparison is made between the United States, Japan, and, to a lesser extent, Western Europe. These major factors are: 1) commercialization of research, development, and design; 2) manufacturing techniques and resources; 3) finance, including both private and public sources of funds; 4) human resources, both quantity and quality; and 5) governmental/industrial policies.

Strategic Command, Control, Communications, and Intelligence (C^3I)

U.S. strategic nuclear forces are intended to deter hostile Soviet actions, and to do so in a way that contributes to international stability. Their ability to meet these objectives depends not only on the character and capabilities of the weapons systems themselves, but also on the character and capability of the supporting C^3I systems. Specifically, both deterrence and stability may depend on: 1) the reliability with which a Soviet attack can be detected; 2) the timeliness and quality of the information about such an attack that can be assembled; 3) the speed and reliability with which this information can be communicated to the National Command Authorities; and 4) the immunity to disruption of communications between the National Command Authorities and the strategic forces.

The purpose of the study is to assess the technical capabilities and vulnerabilities of present U.S. strategic C^3I systems. The study will identify needs and opportunities for improvement in the present systems, with special emphasis on additions to the system that could usefully be made in the near term with available technology. Promising avenues of research for future improvements will also be identified.

International Cooperation and Competition in Civilian Space Activities

Over the next decade, the United States will face strong commercial competition from foreign space technology, and considerable interest from developing countries in cooperative ventures in space science and space applications technologies. This project will evaluate the current status of international competition and cooperation in key areas of space technology, in space science, and for educational and scientific exchange. It will investigate ways in which space technologies and their products could be used as instruments of U.S. foreign policy, and examine military space activities insofar as they affect civilian programs and international commercial and political relations. The project will also assess the implications of various policies to enhance cooperation and/or competition with foreign entities. There will be two distinct but related parts, one assessing U.S. relations with industrialized countries, the other with developing countries. The former will focus on French and Japanese space technology and the institutional mechanisms that have made them strong competitors with U.S. aerospace firms. The latter will focus on the uses of space technology in less developed countries, and evaluate the technical and economic issues that were evident in the United Nations Conference on the Peaceful Uses of Outer Space (UNISPACE '82).

Concern over the U.S. competitive stance vis-a-vis foreign space technology will be a part of the congressional agenda for the next several years, prompted by the development of the space shuttle and by concern over the U.S. position as an international leader in advanced technologies. Whether we are making the best use of space technology and space science as elements of our foreign policy, growing military space activities, and whether the United States is well enough prepared for international technical conferences such as UNISPACE are also of concern to Congress.

HEALTH AND LIFE SCIENCES

Impact of Technology on Aging in America

The aging of the American population raises critical concerns for employment, the retirement system, transportation, health care, recreation, and housing. The large increase in numbers of the 65 year and older age group has occurred because of technological advances that have resulted in better control of infectious and chronic diseases and improved standards of living. New technologies under development today suggest continued change in longevity and functional capacity.

Most current projections of the impact of our aging population assume an elderly population with characteristics similar to that population today—withdrawal from the work force, declining health, increased needs for hospitalization and nursing care, and other characteristics that suggest a highly dependent 65 year and older age group. However, improved health care, increased understanding of the physiology of aging, and other advances in technology may alter the characteristics of the elderly of the future. In addition, applications of computers, robotics, telecommunications, and other technical innovations in the home and workplace may provide new opportunities for increasing the independence, productivity, and quality of life for this segment of our population.

Four areas where the impact of technology will be assessed are health and life sciences, employment, housing and public services, and international aspects (examples of responses to elderly populations in other industrialized countries).

Comparative Assessment of the Commercial Development of Biotechnology

"Biotechnology" refers to the use of biological techniques such as recombinant DNA technology, cell fusion, fermentation, and enzyme technology to produce chemicals, pharmaceuticals, or other substances to act on the environment to increase the quality of life (as in pollution control), or to improve the characteristics of economically important plants and animals. Advantages of biological production over the alternative methods of chemical production or extraction of substances from living tissues include reduced dependence on petroleum substrates or on large quantities of sometimes scarce plant, animal, or human tissues. Estimates of yearly potential markets for substances that could be produced from applications of recombinant DNA technology in just the chemical and pharmaceutical industries are $15 billion and more in the next 20 years.

The potential of biotechnology has stimulated a great deal of corporate activity in the United States in the last 2 years. Many new small firms have been formed and large corporations are developing capability in biotechnology. Foreign activity in the field is intense, especially in Japan, West Germany, France, and the U.S.S.R.

This assessment will evaluate whether biotechnology and associated research and development are developing in the United States in such a way that this Nation is likely to be in a competitive position with other nations in the years ahead. The keys to competitive development of the biotechnology industry in the United States are basic research and the transfer of basic research into commercial application. One major influence on development of the industry in the United States is Government policies on funding of research, patents, health and safety regulations, antitrust laws, and taxation. Equally important and significantly influenced by Government policy are industrial/academic relationships and their influence on funding, research, manpower training, and information flow. New developments in the technology and in support technologies are important to the growth of the industry and will also be examined as part of this assessment. Analysis along the same dimensions as those above will be conducted for selected other countries in order to estimate the probable U.S. position in the biotechnology industry in the next 10 years.

It is also important to consider areas of application in the public interest. Attractive commercial applications may so engage industry that some areas, of great public benefit but higher commercial risk, could languish. The possible Government role in such areas will be investigated.

The Role of Genetic Testing in the Prevention of Occupational Disease

One of the most difficult problems in regulatory policymaking is determining what is a safe level of exposure to chemicals in the workplace. For any particular chemical, the scientific evidence on risk is often conflicting, and the cost of each incremental lowering of exposure levels becomes increasingly expensive. Further, because of the natural variability of humans, what may be safe for one person, or even the vast majority of people, may be hazardous to another. Accordingly, some occupational health specialists have advocated both genetic screening and cytogenetic surveillance of workers as a means of identifying high-risk individuals and environments where the entire work force may be at risk. The use of these techniques is controversial because the ability to actually identify high-risk workers is a matter of scientific dispute and the identification of such workers, if possible, could place their interests in opposition to those of the company.

This assessment will examine the following questions: What is the technological state of the art? Do the claimed associations in fact exist between certain recessive genes or chromosomal abnormalities and increased risk of harm from certain chemicals? If these associations exist, do genetic screening and cytogenetic surveillance offer a cost-effective way to enhance worker health and safety, given the economic and technical fact of life that workers will face some exposure to chemicals? What are the alternatives, regulatory or otherwise? What responsibilities might companies have toward high-risk workers? How might these tests be done in order to protect the interests of all parties?

Specific conditions for which screening tests are available will be examined in detail. They are G-6-PD deficiency, methemoglobin reductase deficiency, alpha-1—antitrypsin deficiency, and aryl hydrocarbon hydroxylase inducibility.

Plants: The Potentials for Extracting Protein, Medicines, and Other Useful Chemicals

Land and marine plants are known to contain some valuable chemical substances that are used in foods for humans and animals, or in pharmaceuticals, pesticides, chemicals, and other products. These compounds are synthesized naturally using the energy from the Sun. Plant products range from oils, gums, and resins to important drugs. Only certain of these naturally occurring compounds have been synthesized in the laboratory. Further, an unknown but probably vast resource of such compounds remains uncharacterized and undeveloped.

Today, renewed attention is being directed to the identification and extraction of plant chemicals and to devising systems for multiple use of a plant's various components. For example, some research points to the possibility of growing tobacco specifically for the purpose of extracting protein from the leaves. The protein that might be extracted from plant leaves could be used to supplement human and animal food, and possibly aid in the treatment of kidney disease.

OTA conducted a workshop designed to identify technological opportunities and constraints for commercially developing protein, pharmaceuticals, chemicals, and other associated extracts from plants generally and tobacco specifically. The study will examine the potential impacts that such technologies might have on improving nutrition and food quality by increasing the availability of high-quality protein. Issues addressed will include: 1) quality of current data bases on chemistry of plant extracts; 2) status of bioassay technologies; and 3) possible social, economic, environmental, and political impacts that such new technologies might generate.

Water-Related Technologies for Sustaining Agriculture in U.S. Arid and Semiarid Lands

Freshwater is a controlling factor of U.S. agricultural productivity. In recent years, the availability of high-quality freshwater for agriculture, especially in the arid and semiarid United States, has become a major concern. In particular, competition for available water supplies, overdraft of underground aquifers, and deteriorating water quality have contributed to severe water supply problems for arid and semiarid U.S. agricultural lands (those receiving about 20 inches or less of rainfall annually).

The principal farming systems in arid and semiarid U.S. lands are irrigation agriculture, dryland farming, and ranching. Irrigation agriculture is one of the most seriously affected by reduced water supplies. This farming system accounts for over 80 percent of all consumed water withdrawn from streams and underground aquifers. About 90 percent of U.S. irrigated land is in the 17 Western States where water is in short supply. In California, Arizona, New Mexico, Nevada, Utah, Wyoming, and Idaho, for example, over 80 percent of the crops are produced with irrigation. Agricultural water supplies suffer from declining water tables as well as agriculture's inability to compete on the open market for the water that is available. Energy costs become a particularly critical factor as water must be transported from greater distances or lifted from deeper aquifers. In addition, many conventional agricultural systems use available water inefficiently. The seriousness of the problem necessitates an assessment of present and emerging water-related technologies and their potential for sustaining arid and semiarid agriculture in the United States.

This assessment will focus on the opportunities of present and emerging technologies to provide long-term sustainable agricultural productivity by increasing efficiency of water use and reducing agricultural water demands in arid and semiarid U.S. lands. The ability of such technologies to improve water quality of agricultural runoff and the associated socioeconomic impacts also will be examined.

Technologies considered will include those that require modification of existing systems to maintain the present style of agriculture and those that involve fundamental changes through the adoption of low-water-demand biological technologies and systems. The assessment will include a critical review of data on the magnitude of the arid/semiarid water problem, potentials for alternative supplies, and possible legal and institutional mechanisms supportive of the adoption of sound agricultural water-related technologies.

Technologies To Sustain Tropical Forest Resources

Each year 1 to 2 percent of the world's remaining tropical forests are converted to other land uses or to wasteland. Where cleared land is developed for sustained agriculture, deforestation can be beneficial. But most land now being cleared cannot sustain farming or grazing with available technologies, so it is abandoned after a few years. Often the forests do not regrow because of highly weathered soils and harsh climates. Thus, highly productive but underused forest resources are giving way to grasslands and deserts of low productivity.

Deforestation has economic and environmental consequences that jeopardize U.S. imports of agricultural germ plasm, pharmaceuticals, chemical feedstocks, foods, drugs, animals for medical research, tropical hardwoods, and veneer and wood products. Also in jeopardy are U.S.-funded development projects in tropical countries, U.S. migratory wildlife species, and stability of global climates. Tropical deforestation places pressure on world oil supplies and is an important causal factor in the increasing number of refugees seeking U.S. entry.

The U.S. Agency for International Development (AID), the United Nations (U.N.) agencies, and the World Bank have increased funding for forestry severalfold in the past 5 years. American corporations and nonprofit institutions also have been increasingly involved in the search for solutions to tropical deforestation problems. Most importantly, many tropical nations' governments recognize that deforestation constrains their economies and their development options; they are now making institutional changes to slow deforestation and to accelerate reforestation.

The United States is recognized for its leadership in bringing the deforestation problems to world attention and for the technical versatility it has to address the problem. Sustaining tropical forest resources can be helped or hindered by applications of certain technologies. OTA will assess:

1. dimensions of the tropical deforestation problem;
2. impacts of technologies, both conventional and new, that the United States may apply to enhance use and management of forest resources;
3. the role that U.S.-funded agencies, such as AID, Peace Corps, the U.N., and the World Bank, play in developing improved technologies;

4. improved mechanisms for transferring such technologies to tropical nations and to tropical regions of the United States; and
5. the special strengths of U.S. institutions in relevant science and technology.

Federal Policies and the Medical Devices Industry

During the past two decades, technologies such as automated blood chemistry analyzers, ultrasound imaging, and cardiac pacemakers have become common elements of medical diagnosis and therapy. The growth of the industry that manufactures such technologies has paralleled the growth of expenditures for medical care. The industry's sales totaled an estimated $13 billion in 1981, more than three times the 1972 level and 11 times the amount in 1958.

Congress is continually called on to develop policies that will affect the medical devices industry, but in the past has lacked adequately analyzed information to appropriately deal with the subject. Federal policies related to the research, marketing, location, and financing (medical insurance) of medical technologies, as well as to the taxation, patenting, and foreign trade of all technologies, affect the development, manufacture, and sale of medical devices.

This assessment will eliminate some of the gaps in basic information about the medical devices industry and analyze the implications of alternative Federal policies. The assessment will develop information about the nature of firms that manufacture medical technologies, conduct case studies of selected medical devices, and examine present and proposed Federal policies that influence the medical devices industry and in turn the cost and effectiveness of medical devices.

Medical Technology and Costs of the Medicare Program

The costs of the Medicare program have been rising rapidly, and medical technology is a prime component of this increase. Of the $247 billion spent on national health expenditures in 1980, the Federal Government paid more than $70 billion, and of that amount nearly $37 billion was for Medicare. A substantial portion (perhaps as high as 50 percent) of increases in total health care costs has been attributed to an increase in the use of new and existing medical technologies.

Reimbursement policy has, in the view of many, led to rapid adoption and often excessive use of medical technologies. One approach to curtailing the growth of costs in the Medicare program is to change the ways in which medical technologies are added to Medicare coverage and the ways in which their use is paid for. For example, certain prospective reimbursement schemes (such as the use of diagnostic-related groups) or the encouragement of cost-reducing technologies have been suggested as ways to reduce Medicare costs. The project is analyzing a broad range of mechanisms to reduce or limit Medicare costs related to medical technology. In addition, it includes case studies of particular medical technologies. Four have been specifically requested: plasmapheresis, alcoholism treatment, variations in length of hospital stay, and continuous ambulatory peritoneal dialysis.

Evaluation of Veterans Administration Agent Orange Protocol

The epidemiologic study by the Veterans Administration of the long-term health effects resulting from exposure to agent orange was mandated in the Veterans Health Programs Extension and Improvements Act of 1979 (Public Law 96-151). The same law requires OTA to review the study design and monitor the conduct of the study. An advisory panel was assembled to carry out the review. The study design was tentatively approved in March of 1982.

Health and Safety Control Technologies in the Workplace

One hundred million Americans work. Each year there are some 2.3 million disabling injuries and 13,200 accidental deaths in the workplace, and perhaps 100,000 people die from job-related diseases. Efforts to reduce this toll involve employers, labor organizations, nonprofit institutions, insurance companies, and Government agencies. To a major extent these efforts are directed at developing and applying control technologies—engineering controls, worker education programs, and personal protection devices.

New industrial plant construction and modernization of existing plants is expected to result from interest in increased productivity and reduced energy consumption. Such construction may offer opportunities for installing new technologies to reduce workplace health and safety hazards.

This assessment would develop information about research and development, diffusion, application, and evaluation of workplace control technologies. Engineering controls, worker education programs, personal devices, and interrelationships between them will be described and their role in worker protection evaluated.

One product of the assessment would be a series of options. These are expected to address:

- improving data about workplace accidents and illnesses;
- aiding development of appropriate technologies, their diffusion, application, and evaluation; and
- making control technologies available to small firms at a price they can afford.

Special Responses

Food and Agricultural Postharvest Technology and Marketing Research

This Technical Memorandum was requested as a follow-up to the U.S. Food and Agricultural Research assessment.

Debate continues between the executive and legislative branches on the role of the public sector in this specific research activity. This study will help to provide guidelines on the proper role of the public sector in this research area.

The Impact of Randomized Clinical Trials on Health Policy and Medical Practice

The randomized clinical trial (RCT) is an experimental method considered by many to be the sine qua non for evaluating the efficacy and safety of medical technologies. RCTs came into widespread use during the 1960's and 1970's, accounting for an increasing share of medical research moneys. In 1979 the National Institutes of Health, the largest supporter of biomedical research in this country, funded 986 clinical trials, about 60 percent of which were RCTs.

Rapid growth in technology-related medical costs and related heightening of interest in assessing medical drugs, devices, and procedures, make the RCT an ever more important tool for decisionmaking. This Background Paper examines the impact of RCTs on health policy and medical practice in the United States, based on a review of the literature and discussions with experts in the field. The following topics are included:

- a brief history of the RCT, from simple beginnings in the late 1940's to the current sophisticated multicenter trials involving thousands of participants, along with a discussion of financial support for RCTs;
- a description of the method, and the basic arguments for and against both RCTs and the alternatives to RCTs;
- the use of RCTs in policymaking, including their role in new drug and device approval under the Food, Drug, and Cosmetic Act; and their use in coverage decisions for Medicare and by private third-party payers;
- a review of literature dealing with the impacts of RCTs in various fields;
- a discussion of the characteristics of RCTs that determine what their impact will be, e.g., the timing of the trial, the field of medicine, the type of intervention (surgical v. medical; preventive v. therapeutic), the statistical power of the study;
- the impacts of RCTs in cardiovascular disease and cancer, the areas in which the most RCTs have been done; and
- identification of strategies for improving the impact of RCTs.

Information Content of Premanufacture Notices

The Premanufacture Notice Review Program, established by the Toxic Substances Control Act (TSCA), is the U.S. Government's effort to identify toxic substances before they enter commerce, to impose controls when necessary, and thereby to reduce unreasonable risks to human health and the environment. TSCA requires that a premanufacture notice (PMN) be submitted to the Environmental Protection Agency (EPA) at least 90 days before a new chemical is manufactured or imported into the United States.

Using the information in the PMN and professional judgment, EPA reviews each PMN to determine if the chemical described in the notice may present an unreasonable risk to human health or the environment. In the event that EPA determines the substance presents or may present an unreasonable risk, EPA can regulate its manufacture.

PMNs are to contain certain information about the new chemical to enable EPA to make decisions necessary to protect human health and the environment under the provisions of TSCA. Because TSCA does not allow EPA to require that information be generated about a substance simply because the substance is new, it was expected that the amount and type of information present on PMNs would vary.

This Technical Memorandum describes the information content of all PMNs received by EPA in the first 23 months of the program's operation (July 1979 through June 1981) and those submitted in June 1982. In addition, the information reported on PMNs that describe chemicals of certain specified classes were analyzed separately. For instance, those PMNs that describe chemicals that, according to EPA records, are now being manufactured were analyzed and compared to those that described chemicals that have not yet been manufactured. EPA is considering exempting some classes of chemicals from PMN reporting requirements. PMNs submitted for the classes of chemicals likely to be exempted—chemicals used only at the site of manufacture, chemicals to be manufactured in amounts of less than 10,000 kilograms annually, and polymers—were also analyzed separately.

The results of the analyses show that the reporting of toxicity information varies among different classes of PMNs and that no toxicity data are reported to EPA on about 40 percent of new chemicals. Whether toxicity data are reported on chemicals which are of most concern (because of potential hazard) cannot be determined without reviewing the decisionmaking process for particular chemicals, which is beyond the scope of this study.

SCIENCE, INFORMATION, AND NATURAL RESOURCES

Information Technology Research and Development

Computer and communications technologies are vital components of the domestic economy. In 1981, computers and business machines alone provided a $6.9 billion surplus to the U.S. balance of trade. Computers and communications also form the information services network that supports and enhances productivity in every other sector of the economy. In addition, they are indispensable components of our national security system.

Underlying current U.S. leadership in information technology has been a strong national research and development (R&D) effort led in communications by the industrial sector, and in computers by both industry and Government. Those traditional patterns of R&D are likely to alter significantly due to shifts in industry structure, Federal science and technology policy, international competition, and technological advances that are now taking place. These changes will affect who will do research, what areas are chosen, levels of support, and the balance between long-term exploratory research and short-term development. They will be strongly influenced by Federal policy, both directly by trends in R&D support and indirectly by tax, antitrust, regulatory, copyright, and education policy.

OTA will characterize these shifts in R&D, project their implications for U.S. leadership in computer and communication technology, and analyze the potential influences of Federal policy on the directions and levels of R&D support.

Information Technology, Automation, and the Workplace

In this decade, new computer and communication technology will provide the foundation for a new wave of industrial automation based on such applications as computer-aided-design, computer-aided-manufacturing, robotics, and management information systems. These technologies will be merged to form flexible manufacturing systems.

While computerized (or "programmable") automation is expected to enhance the productivity and competitiveness of the particular industries that use it, it is also likely to have significant broader impacts on the Nation's economy, industrial structure, and work force. Computerized automation will thus present both opportunities and problems to Federal policymakers concerned with the state of the U.S. economy, international trade, employment, and labor training programs.

The objectives of this assessment are to analyze the following:

- Trends and the state of research and development in computerized manufacturing technologies over this decade.
- The development of industries producing computerized manufacturing equipment, software, and services.
- The potential utility of computerized automation for various categories of manufacturing industries that might use it.
- Impacts on employment—job loss, job creation, job redefinition; new skill needs; and workplace quality.
- Implications for education and training, for general technological literacy, for specialized vocational skills, and for scientific and engineering expertise.
- The impacts of Federal policy options on the development and use of computerized automation systems in U.S. manufacturing.

Effects of Information Technology on the Structure of the Financial Services Industry

The use of new telecommunication and computer technologies in the financial services industry is changing both the character of the industry and the relationships between it and its customers. The technology allows financial institutions to alter and diversify the services offered, to distribute them more broadly, and to link them together into national and worldwide networks. Technology also enables firms that have not previously offered financial services to enter the market—firms often unconstrained by the regulatory structure under which traditional providers of financial services have operated. Future technological developments may offer additional possibilities for the development of innovative financial services for both individual consumers and businesses. Thus, technological imperatives could significantly change the structure of the financial services industry, an area of economic activity that has long been of interest to Congress.

The study will examine:

1. technologies that are likely to be employed in delivering financial services in the future;
2. the nature of the services that may be provided; and
3. alternative structures of the financial services industry that may emerge as a result of applying new and existing technologies, particularly as they affect Federal policy.

The Patent System and New Technological Enterprises

Economists differ in their appraisals of the exact contribution small technologically based firms make to innovation, employment, and economic progress; however, it is possible that the contribution level is high and that these enterprises are essential to the growth and revitalization of our society. Fledgling entrepreneurs and independent innovators are frequently dependent on, and influenced by, the patent system to a much greater degree than are large, established firms. In almost all aspects of the patent system—e.g., prosecution, interferences, licensing, litigation—small firms and individual inventors face far more difficult obstacles and economic choices than do the large firms. The importance of new technologically based firms to the future economic vitality of the United States underscores the need to assess the impact of the patent system on the generation and stimulation of such enterprises.

Maritime Trade and Technology

The application of new technology within the maritime industry appears to have produced far more benefits to nations other than the United States. While the United States is the world's foremost trading nation, the ships that carry over 95 percent of that trade are registered in other countries. Shipbuilding in the United States is at a low ebb. Compared to other maritime nations, U.S. productivity is low and shipyards are technologically behind.

A number of significant changes in Federal maritime policy have been recently proposed or implemented in an effort to reduce subsidies, eliminate unnecessary regulation, and provide a more competitive and productive economic environment. While these goals are broadly supported, it is not clear which methods will be most effective for achieving them and, at the same time, maintaining an adequate industrial base. This study will analyze the status of U.S. technology in shipping and shipbuilding and compare trends in maritime trade with national and international maritime policies.

Impacts of Atmospheric Alterations

Many present-day human activities—particularly the burning of fossil fuels—are altering the Earth's atmosphere in potentially harmful ways. The precise nature and extent of such activities are unclear. However, the potential consequences are severe enough to merit careful congressional consideration of domestic and international Federal policies.

Some of the consequences, such as acid rain, are occurring today. Others, such as global climate changes due to increasing carbon dioxide concentration, may appear within the next century. Increasing sulfur and nitrogen oxides and their transformation products (acid rain and oxidants) may damage thousands of lakes, decrease crop and forest productivity, deplete soil nutrients, damage buildings and monuments, and have adverse effects on human health.

The assessment will characterize the potential benefits of acting now to abate long-range transport air pollution and the potential costs of action that may be premature. The study will: 1) identify the resources potentially at risk, as well as the societal concerns about the loss of these resources; and 2) identify broad pollution control strategies, and discuss their costs, potential effectiveness, and societal effects. OTA will develop a range of plausible, regionally oriented impact scenarios which describe the potential environmental and social consequences of transported pollutants, and actions that might be taken to control them. These scenarios will not attempt to "forecast" the future, but instead present a range of plausible consequences of these changes, in terms responsive to near-term congressional decisions.

Assessment of Approaches to Wetlands Use

Both the development and the preservation of wetlands—swamps, marshes, bogs, and other areas that are periodically saturated with water—offer benefits to individual users of wetlands as well as to society as a whole. For example, when drained or filled, some wetlands may be converted into highly productive farmland or choice residential or commercial property. Valuable oil, gas, and timber resources may also be extracted from some wetland areas. Many other technological activities, such as the construction of dams, levees, breakwaters and jetties, and bridges and highways, often take place in wetlands. Similarly, undeveloped wetlands may provide flood control, fish and wildlife habitat, erosion protection, pollution control, and ground water recharge.

In the past, the values of undeveloped wetlands have largely been ignored or seen as less than those of developed or technologically modified wetlands. As a result, approximately 30 percent of the Nation's original wetlands have been modified in some way by various technological activities. During the last decade, the importance of the natural functions of wetlands has received increasing recognition. In response to concerns about wetlands, many Federal and State laws now influence the development and regulate the use of wetlands through measures such as acquisition, economic incentives, and permitting.

Proposals to develop wetlands have frequently led to controversy. To provide a framework for future debates on this issue, OTA will evaluate:

- the effects of technological activities on wetlands,
- technological and nontechnological options for mitigating undesired impacts,
- the functional values of different types of wetlands,
- problems associated with weighing the benefits of technological activities in wetland areas against the functional values of the wetlands that may be lost, and
- various approaches to wetlands use.

U.S. Passenger Rail Technologies

The recent announcement by the newly formed, privately chartered, American High Speed Rail Corp. of its planned $2 billion high-speed passenger rail corridor between Los Angeles and San Diego has stimulated existing congressional interest in the introduction of high-speed and other advanced rail technologies, including Magnetic Levitation, in the United States. This interest is also reflected in the growing number of private and publicly funded feasibility studies of these technologies in selected regions and transportation corridors. OTA will assess these intercity passenger rail technologies and the potential impacts of their introduction in the United States.

Technology, Innovation, and Regional Economic Development

In the last 10 to 20 years, several regions of the United States have developed strong local economies based on fast-growing "high-technology" firms that are engaged in the systematic development and commercialization of new products, processes, and services. These firms and the industries they compose are an important factor in U.S. international competitiveness and a major source of new manufacturing jobs. Several Federal policies are aimed at encouraging their growth. Many State and local development programs are also based in part on strategies for attracting or stimulating the formation of small, high-technology companies.

The assessment will determine where high-technology firms are appearing and what factors influence their distribution and growth, identify and evaluate the effectiveness of State and local initiatives to encourage innovation and high-technology development, explore the changing opportunities presented by new and emerging technologies such as robotics and bioengineering, and address the appropriate Federal role in affecting the conditions for such growth in the future.

Civilian Space Stations

Over the past quarter century, the United States has continued to increase its capabilities for operating in space. The success of the fourth shuttle flight has brought the vehicle to operational status. The shuttle will require a certain amount of follow-on work, but the National Aeronautics and Space Administration (NASA) is now ready to undertake a major new project, the development of a permanent manned facility, or space station, to be placed in low-Earth orbit. NASA is reportedly planning to request funds in fiscal year 1984 to initiate this program, and has already formed a task force to manage it. The overall, multiyear effort is estimated to cost a total of $8 billion to $20 billion.

This assessment of nonmilitary space stations addresses the following issues: What advances in science and technology, current or expected, make development of a space station attractive now? What services could a station provide to the civilian sector? Who are the potential users? Given an identified community of users, can their needs be met most effectively by means of a station? Are there additional science and applications needs that a station cannot meet? Are there alternative facilities in prospect that could meet such requirements? If so, is the argument for a space station weakened? What are the prospects for international cooperation in its construction and use? What reasonable solutions exist for potential conflicts between military and civilian interests?

Airport System Development

The National Airspace System Plan issued by the Federal Aviation Administration (FAA) in January 1982 states that "airport capacity limitations at busy airports will be the constraining element in the National Airspace System." FAA anticipates that few, if any, new air carrier airports will be built in the next 20 years and that capacity expansion of existing airports will be severely limited by the availability and cost of land, concern about the environment and airport noise, and landside access constraints.

OTA will assess the technologies to be applied to increase capacity or improve service at airports and the mechanisms by which the technology can be deployed and brought to bear on the problems of civil aviation.

Section IV.—Organization and Operations

Created by the Technology Assessment Act of 1972 (86 Stat. 797), OTA is a part of and is responsible to the legislative branch of the Federal Government. OTA received funding in November 1973 and began operations as the second session of the 93d Congress convened in January 1974.

The act provides for a bipartisan Congressional Board, a Director, and such other employees and consultants as may be necessary to conduct the Office's work.

The Congressional Board is made up of six Senators, appointed by the President pro tempore of the Senate, and six Representatives, appointed by the Speaker of the House, evenly divided by party. In 1982, Sen. Ted Stevens (R-Alaska) and Cong. Morris Udall (D-Arizona) served as the Chairman and Vice Chairman, respectively, of the Board. The two posts alternate between the Senate and House with each Congress. The Board members from each House select their respective officer.

The Congressional Board sets the policies of the Office and is the sole and exclusive body governing OTA. The Board appoints the Director, who is OTA's chief executive officer and a nonvoting member of the Board.

The act also calls for a Technology Assessment Advisory Council comprised of 10 public members eminent in scientific, technological, and educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. The Advisory Council advises the Board and the Director on such matters as the balance, comprehensiveness, and quality of OTA's work, and OTA's nongovernmental resources.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships of the applications of technology; identify alternative technological methods of implementing specific actions; identify alternative programs for achieving requisite goals; estimate and compare the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be necessary.

INITIATION, PROCESSING, AND FLOW OF ASSESSMENTS

OTA's primary function is to provide congressional committees with assessments or studies that identify the range of probable consequences, social as well as physical, of policy alternatives affecting the uses of technology. Requests for OTA assessments may be initiated by:

- the chairman of any standing, special, select, or joint committee of Congress, acting alone, at the request of the ranking minority member, or a majority of the committee members;
- the OTA Board; or
- the OTA Director, in consultation with the Board.

The authorization of specific assessment projects and the allocation of funds for their performance is the responsibility of the OTA Board. The Board early establishes priority areas of study, and approves individual assessment projects within those areas. To help in making these decisions, the Board considers recommendations and plans developed by OTA staff, and applies the following general selection criteria developed in consultation with the Advisory Council:

- Is this now or likely to become a major national issue?
- Can OTA make a unique contribution, or could the requested activity be done effectively by the requesting committee or another agency of Congress?
- How significant are the costs and benefits to society of the various policy options involved, and how will they be distributed among various affected groups?
- Is the technological impact irreversible?
- How imminent is the impact?
- Is there sufficient available knowledge to assess the technology and its consequences?
- Is the assessment of manageable scope—can it be bounded within reasonable limits?
- What will be the cost of the assessment?
- How much time will be required to do the assessment?
- What is the likelihood of congressional action in response to this assessment?
- Would this assessment complement or detract from other OTA projects?

Assessment reports emerge from the combined effort of a staff with appropriate expertise, citizen advisory panels of experts, consultants, contractors, and other congressional information agencies. A particular assessment project may involve exploratory meetings, workshops or advisory panels, staff analyses, and consultant studies.

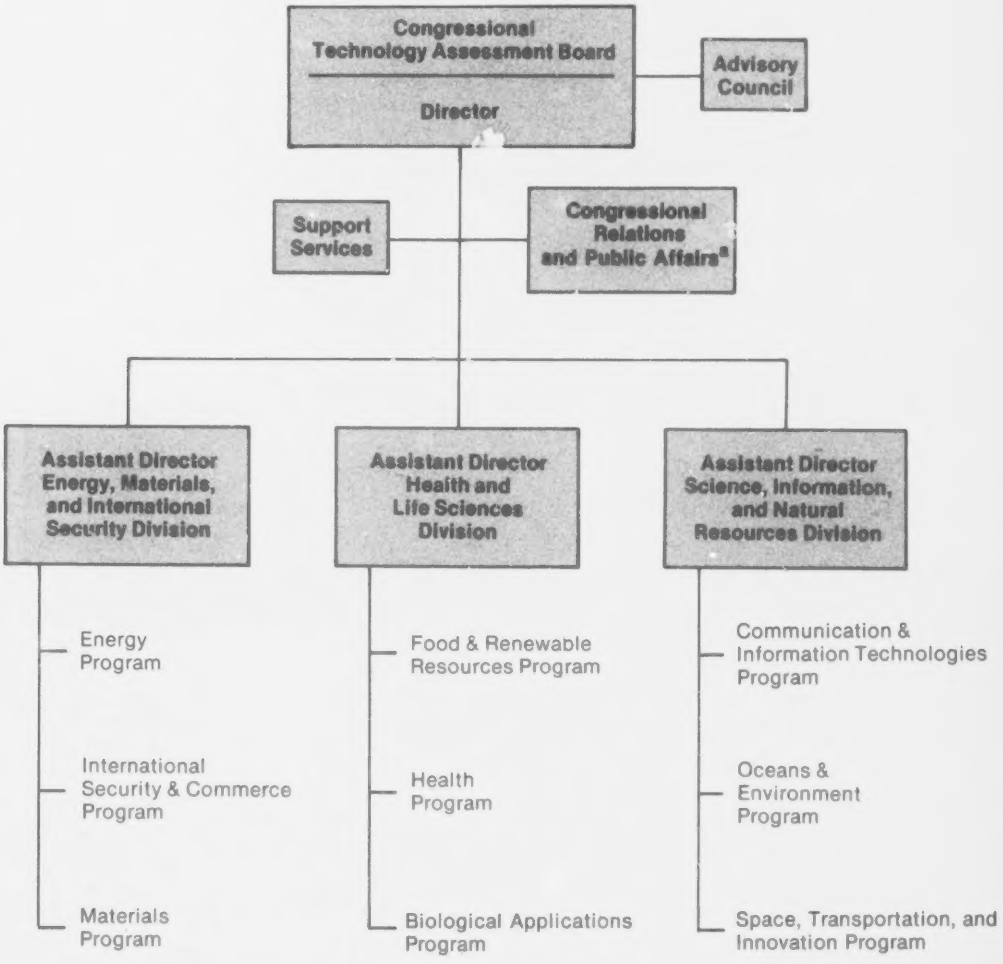
Different approaches are used. The method employed, personnel involved, and the skills tapped depend on the technology under study, the requesting client, the nature of the issues at stake, and the time available for and the setting of the project. Required to consider the needs of Congress, the vast range of technological issues, and the resources available for a study, OTA remains flexible in its assessment methods.

All OTA assessments strive to be objective, fair, nonpartisan, and authoritative. They must also be timely so as to meet congressional schedules.

ORGANIZATIONAL STRUCTURE

The Office is organized into three operating divisions, each headed by an assistant director. The three divisions are Energy, Materials, and International Security; Health and Life Sciences; and Science, Information, and Natural Resources. They encompass assessments grouped in the areas of energy; international security and commerce; materials; biological applications; food and renewable resources; health; communication and information technologies; oceans and environment; and space, transportation, and innovation. See chart detailing OTA's organizational structure.

OTA ORGANIZATION CHART


Congressional Technology Assessment Board
Director
Advisory Council
Support Services
Congressional Relations and Public Affairs[a]
Assistant Director Energy, Materials, and International Security Division
Assistant Director Health and Life Sciences Division
Assistant Director Science, Information, and Natural Resources Division
Energy Program
International Security & Commerce Program
Materials Program
Food & Renewable Resources Program
Health Program
Biological Applications Program
Communication & Information Technologies Program
Oceans & Environment Program
Space, Transportation, and Innovation Program

[a] Effective January 1983.

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

Public Involvement

The private sector is heavily involved in OTA studies as a source of expertise and perspectives while an assessment is in progress. Contractors and consultants are drawn from industry, universities, private research organizations, and public interest groups.

OTA works to ensure that the views of the public are fairly reflected in its assessments. OTA involves the public in many ways—through advisory panels, workshops, surveys, and formal and informal public meetings. These interactions provide citizens with access to information and help OTA identify contrasts between the perspectives of technically trained and lay citizens.

OPERATIONS

Publishing Activities

During 1982, OTA delivered 55 published documents to Congress. These included: 18 assessment reports, 15 summaries, 3 technical memorandums, 9 background papers, 5 working papers (appendixes), 1 interim draft, and 4 administrative reports.

Requests for Publications

The OTA Publishing Office received and processed 37,972 separate telephone and mail requests (an average of 150 per day) for publications during calendar year 1982 (this figure almost tripled that of calendar year 1981). Of these, 3,529 were requests from congressional offices (increased by more than 61 percent from 1981; an average of 14 per day); and 34,443 requests from noncongressional sources. A majority of the noncongressional requests were referred to the Government Printing Office for purchase of OTA documents. Additional requests were processed by OTA program offices and the OTA Congressional and Public Communications Office and are not included in the above statistics.

Private Sector Reprinting

Through calendar year 1982, 34 OTA publications have been reprinted (in whole or in part) by commercial publishers or private organizations for various audiences. Among the publications reprinted during calendar year 1982 are:

- *Springer Publishing Co.*
    - Technology and Handicapped People
    - The Management of Health Care Technology in Nine Countries
- *Congressional Information Services*
    - Use of Models for Water Resources Management, Planning, and Policy
- *University of Oregon, THE COMPUTING TEACHER*
    - Summary, Informational Technology and Its Impact on American Education
- *Lawyers Co-operative Publishing Co. and Bancroft-Whitney Publishers*
    - Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity
- *Association for Computing Machinery*
    - Summary, Computer-Based National Information Systems
- *Banbury Center, Cold Spring Harbor Laboratory*
    - Impacts of Applied Genetics
- *State University, Sydney, Australia*
    - The Direct Use of Coal

Additionally, OTA's publication *Computer-Based National Information Systems* was used as a textbook for a course offered by the University of Maryland.

Sales of Publications

Government Printing Office.—Sales of OTA publications by the Superintendent of Documents continue to increase. In 1981 the number of titles put on sale was 138 and GPO sold 26,206 ccopies. In 1982, the number put on sale was 117, and GPO sold 26, 506, an increase of 300 copies with 21 fewer titles.

Summary of Cumulative Sales of OTA Publications Through the Superintendent of Documents, GPO (July 1976 through December 1982)

	As of 12/81	As of 12/82	12 mos. difference
Number of individual titled publications put on sale to the public	138	117	−21
Total number sold	150,995	177,501	+26,506
Estimated GPO gross reciepts from sales[a]	$749,442	$880,393	+$130,951

[a] Based on a single copy selling price.

National Technical Information Service.—NTIS sells scientific reports and papers that are, generally, not in great demand but are useful for scientific researchers. NTIS is the outlet for OTA's assessment working papers and contractor reports, plus those reports that are out of print by GPO. NTIS has sold 20,147 copies of OTA reports through December of 1981.

Organizational Roster of OTA Staff as of December 1982

OFFICE OF THE DIRECTOR

John H. Gibbons, *Director*
Sue Bachtel, *Executive Assistant*
Holly Gwin, *Secretary*
Barbara O'Bryan, *Secretary*

Congressional Relations and Public Affairs Office

Edwin K. Hall,* *Director of CRPA*
Patricia Halley, *Secretary*
Jean McDonald, *Press Officer*
Annette Taylor, *Assistant to the Press Officer*
Eugenia Ufholz, *TAB/TAAC Relations*

Medical Services

Rose McNair, *Resident Nurse*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Lionel S. Johns, *Assistant Director*
Beth Alexiou, *Division Assistant*
Henry Kelly, *Senior Associate*

Energy Program

Richard Rowberg, *Program Manager*
Thomas Bull, *Senior Analyst*
Virginia Chick, *Secretary*
Alan Crane, *Project Director*
Nancy Naismith, *Project Director*
Steve Plotkin, *Project Director*
Mary Procter, *Senior Analyst*
Pidge Quigg, *Administrative Assistant*
Jenifer Robison, *Project Director*
James Ryan, *Senior Analyst*
Edna Saunders, *Secretary*
Joanne Sedor, *Analyst*
David Strom, *Analyst*
Richard Thoreson, *Senior Analyst*

International Security and Commerce Program

Peter Sharfman, *Program Manager*
John Alic, *Project Director*
Bruce Blair, *Project Director*
Martha Harris, *Project Director*
Helena Hassell, *Secretary*
Nancy Lubin, *Analyst*
Dorothy Richroath, *Editorial Assistant*
Jacqueline Robinson, *Administrative Assistant*
Ray Williamson, *Project Director*

Materials Program

Audrey Buyrn, *Program Manager*
Lance Antrim, *Project Director*
Patricia Canavan, *Secretary*
James Curlin, *Project Director*
Carol Drohan, *Administrative Assistant*
Iris Goodman, *Research Analyst*
Julie Gorte, *Analyst*
Joel Hirschhorn, *Project Director*
Karen Larsen, *Senior Analyst*
Suellen Pirages, *Senior Analyst*

HEALTH AND LIFE SCIENCES DIVISION

David Banta, *Assistant Director*
Ogechee Koffler, *Division Assistant*

Biological Applications Program

Gretchen Kolsrud, *Program Manager*
Lynne Alexander, *Secretary*
Susan Clymer, *Research Analyst*
Jeff Karny, *Project Director*
David McCallum, *Project Director*
Teri Miles, *Secretary*
Nanette Newell, *Project Director*
Frank Packer, *Research Analyst*
Fatimah Taylor, *Administrative Assistant*
Louise Williams, *Senior Analyst*

Food and Renewable Resources Program

Walter E. Parham, *Program Manager*
Phyllis Balan, *Administrative Assistant*
Nellie Hammond, *Secretary*
Alison Hess, *Research Analyst*

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*Appointed effective January 1983.

Barbara Lausche, *Project Director*
Michael Phillips, *Project Director*
Bruce A. Ross, *Project Director*
Phyllis Windle, *Analyst*

Health Program

Clyde Behney, *Program Manager*
Anne Kesselman Burns, *Project Director*
Virginia Cwalina, *Administrative Assistant*
Hellen Gelband, *Analyst*
Michael Gough, *Project Director*
Mary Harvey, *Secretary*
Gloria Ruby, *Analyst*
Pamela Simerly, *Secretary*
Jane Sisk, *Project Director*

SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION

John Andelin, *Assistant Director*
Doris Smith, *Division Assistant*
John Burns, *Senior Editor*

Communication and Information Technologies Program

Rick Weingarten, *Program Manager*
Prudence Adler, *Analyst*
Marjory Blumenthal, *Project Director*
Beth Brown, *Senior Analyst*
Elizabeth Emanuel, *Administrative Assistant*
Linda Garcia, *Analyst*
Shirley Gayheart, *Secretary*
Zalman Shavell, *Project Director*
Jean Smith, *Analyst*
Donna Valtri, *Analyst*
Fred Wood, *Project Director*

Oceans and Environment Program

Robert Niblock, *Program Manager*
Chris Ansell, *Research Analyst*
William Barnard, *Project Director*
Kathleen Beil, *Administrative Assistant*
Rosina Bierbaum, *Analyst*
Thomas Cotton, *Senior Analyst*
Robert Friedman, *Project Director*
Peter Johnson, *Project Director*
Daniel Kevin, *Analyst*
Jacqueline Mulder, *Secretary*
Kay Senn, *Secretary*
Paula Stone, *Senior Analyst*

Space, Transportation, and Innovation Program

William Mills, *Program Manager*
Phil Chandler, *Analyst*
Marsha Fenn, *Administrative Assistant*
Karen Gamble, *Analyst*
Larry L. Jenney, *Project Director*
Paul Phelps, *Project Director*
Paula Walden, *Research Analyst*
John Young, *Project Director*

OPERATIONS DIVISION

Bart McGarry, *Operations Manager*
Ann Woodbridge, *Management Analyst*

Administrative Services

Thomas P. McGurn, *Administrative Officer*
Susan Carhart, *Director of Contracts and Legal Counsel*
Alexandra Ferguson, *Contract Specialist*
Edith Franzen, *Conference Center Coordinator*
Lisa Raines, *Contract Specialist*

Budget and Financial Operations

Jane Easton, *Budget and Finance Officer*
Joan Camino, *Budget and Accounting Assistant*
Loretta O'Brien, *Data Base Administrator*

Information Center

Martha Dexter, *Manager, Information Services*
Suzanne Boisclair, *Information Technician*
Vermille Davis, *Information Technician*
Diane Rafferty, *Asst. Manager, Information Services*

Personnel Office

William Norris, *Personnel Officer*
Lola Craw, *Personnel Specialist*
Denise DeSanctis, *Personnel Assistant*

Publishing Office

John C. Holmes, *Publishing Officer*
John Bergling, *Graphic Designer/ Illustrator*
Kathie S. Boss, *Assistant Technical Specialist*
Debra Datcher, *Administrative Assistant*
Joe Henson, *Deputy Publishing Officer*

Appendixes

Meeting of the Advisory Panel for the OTA assessment of Approaches to Wetlands Use. Seated at the head table (top of photo) are Robert Niblock, Manager of OTA Programs on Oceans and Environment; William Barnard, OTA Project Director of the Wetlands Assessment; William H. Patrick, Jr., Chairman of the Advisory Panel and Director of the Laboratory for Wetland Soils and Sediment, Louisiana State University; and John Andelin, Jr., Assistant Director, OTA Division of Science, Information, and Natural Resources. The Advisory Panel includes representatives from industry, academia, State and local government, and environmental groups

Appendix A
List of Advisors and Panel Members

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Energy Program

Industrial and Commercial Cogeneration Advisory Panel

James J. Stukel, *Chairman*
Director
Public Policy Program
College of Engineering
University of Illinois

Roger Blobaum
Roger Blobaum & Associates

William H. Corkran
General Manager
The Easton Utilities Commission

Claire T. Dedrick
Air Resources Board
State of California

Steven Ferrey
Energy Counsel
National Consumer Law Center, Inc.

Todd La Porte
Institute of Government Studies
University of California

Evelyn Murphy
c/o Evelyn Murphy Committee

Theodore J. Nagel
Senior Executive Vice President
American Electric Power Service Corp.

Thomas W. Reddoch
Oak Ridge National Laboratory

Bertram Schwartz
Senior Vice President
Consolidated Edison Co. of New York

Harry M. Trebing
Director, Institute of Public Utilities
Michigan State University

Thomas F. Widmer
Vice President
Engineering Thermo Electron Corp.

Robert H. Williams
Center for Environmental Studies
Princeton University

The Energy Efficiency of Buildings in Cities Advisory Panel

William Reilly, *Chairman*
Conservation Foundation

Francis Hooks Burr
Attorney, Ropes & Gray

Vernon Friason
F & H Services

Lenneal Henderson
Howard University

Michael Hogan
Hogan Associates

George Latimer
Mayor, City of St. Paul

Hewitt Lovelace
Public Safety Director

Neal R. Peirce
Contributing Editor
National Journal

George Peterson
Director of Public Finance
The Urban Institute

John H. Robson
Vice President
Marquette Fuels, Inc.

Terry L. Sinnott
Commercial Sales Manager
San Diego Gas & Electric

Victoria J. Tschinkel
Secretary
Department of Environmental Regulation
State of Florida

James A. Walker
Commissioner
Energy Resources Conservation and Development Commission
Office of the Commissioners

Joseph E. Widmayer
Executive Vice President
Complete Building Services, Inc.

Industrial Energy Use Advisory Panel

Herbert Fusfeld
Director
Center for Science and Technology Policy
New York University

E. Milton Bevington
President
Servidyne, Inc.

Harold Bogart

Carlton Burtt
Equitable Life Assurance of the United States

William U. Chandler
Director
Energy Conservation Project
Environmental Policy Institute

William Cunningham
AFL-CIO
Research Department

Gordon Geiger
Mining and Materials Division
Chase Manhattan Bank, N.A.

J. M. Leathers
Dow Chemical Co.

Harvey N. Morris
Harvey Morris Associates

John Myers
Department of Economics
Southern Illinois University

Rudolph G. Penner
Resident Scholar
American Enterprise Institute

R. B. Pool
Kaiser Aluminum & Chemicals Corp.

Rosalie Wolf
International Paper Co.

Steel Industry Workshop Attendees

Fred Corban
Inland Steel Co.

Robert Crandall
The Brookings Institution

George Ferris

Jim Gay
Vice President Operations
North Star Steel

James Hamilton
Manager, Governmental Affairs
U.S. Steel Corp.

Jerry Houck
American Iron and Steel Institute

Jack Kiefer
Manager of Energy Systems
Cameron Iron Works, Inc.

Joe Kotelchuck

Roy Leidner
Bethlehem Steel Corp.

Gary Myers
Armco Steel

Lou Schorsch
American Iron and Steel Institute

Joseph Wyman
Shearson/American Express

The Future of Conventional Nuclear Power Advisory Panel

George Rathjens, *Chairman*
Center for International Studies

Jan Beyea
National Audubon Society

Richard Dean
General Atomics Corp.

George Dilworth
Tennessee Valley Authority

Linn Draper
Gulf States Utilities

Fritz Heimann
General Electric Co.

Leonard Hyman
Merrill Lynch, Pierce, Fenner & Smith

Robert Koger
North Carolina Utilities Commission

Myron Kratzer
International Energy Associates, Ltd.

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*Deceased.
*Commission was dissolved Dec. 31, 1979.

Michael Yarymovych
Vice President, Engineering
Rockwell International

Observers:

Charles R. Foster
Associate Administrator for
Aviation Standards
Federal Aviation Administration

James J. Kramer**
Associate Administrator for
Aeronautics
and Space Technology
National Aeronautics and
Space Administration

Air Service to Small Communities Working Group

Jane H. Bartlett
President
Arlington League of Women Voters

David Brewster
Senior Designer
Babcock & Schmid Associates, Inc.

Tulinda Deegan
Director, Government Relations
Commuter Airline Association of
America

James Dougherty
Consultant
General Aviation Manufacturers
Association

Marcy Fannon
President
Aviation Service Co.

Harry W. Johnson
General Aviation Office
National Aeronautics and
Space Administration

David S. Stempler
Chairman, Government Affairs
Committee of the Board of Directors
Airline Passengers Association, Inc.

Janet St. Mark
President
SMS Associates

Shirley Ybarra
Vice President
Simat, Helliesen & Eichner

Finance and Program Alternatives Working Group

Richard Alpagh
Chief, Non-Highway Transportation
Branch
Department of Energy

Jane H. Bartlett
President
Arlington League of Women Voters

Richard D. Fitzsimmons
Director, Advanced Program
Engineering
Douglas Aircraft Co.

Jack I. Hope
President
HAECO, Inc.

William Sens (Retired)
Pratt & Whitney Engine Co.

Armand Sigalla
Chief, Technology Preliminary Design
Boeing Commercial Airplane Co.

John Wesler
Director of Environment and Energy
Federal Aviation Administration

Bruce R. Wright
John Claus
Lockheed California Co.

Airport and Air Traffic Control System Advisory Panel

Raymond L. Bisplinghoff, *Chairman*
Vice President and Director of R&D
Tyco Laboratories

Jesse Borthwick
Executive Director
National Association of Noise Control
Officials

Secor D. Browne
Secor D. Browne Associates, Inc.

Jack Enders
President
Flight Safety Foundation, Inc.

Robert Everett
President
The Mitre Corp.

Matthew Finucane
Director
Aviation Consumer Action Project

William T. Hardaker
Assistant Vice President
Air Navigation/Traffic Control
Air Transport Association

**Resigned from panel during conduct of study after leaving NASA.

William Horn, Jr.
National Business Aircraft Association, Inc.

Jack D. Howell
Air Line Pilots Association
International

Alton G. Keel, Jr.
Assistant Secretary of the Air Force
Research, Development and Logistics

Clifton A. Moore
General Manager
Department of Airports
City of Los Angeles

Thomas L. Oneto
Planning Officer
Aircraft Owners & Pilots Association

Robert E. Poli
President
Professional Air Traffic Controllers Association

Gilbert F. Quinby
Consultant

David S. Stempler
Airline Passenger Association

Janet St. Mark
President
SMS Associates

Richard Taylor
Vice President
Boeing Commercial Airplane Co.

David Thomas
Consultant
General Aviation Manufacturers Association

Review of the FAA 1982 National Airspace System Plan

Growth Scenarios Workshop Attendees

Robert W. Simpson, *Chairman*
Professor
Flight Transportation Laboratory
Massachusetts Institute of Technology

Samuel C. Colwell
Director of Market Planning
Fairchild Industries, Inc.

Herman Gilster
Manager, Traffic and Economic Forecasting
Boeing Commercial Airplane Co.

David Lewis
Principal Analyst
Natural Resources and Commerce Division
Congressional Budget Office

David J. McGowan
Manager, Systems Operations
General Aviation Manufacturers Association

Robert E. Monroe
Vice President for Data Research
Aircraft Owners & Pilots Association

Barney Parrella
Manager, Airport Planning and Development
Air Transport Association

Gilbert F. Quinby
Consultant

John Slowik
Vice President
Airline and Aerospace Department
Citibank, N.A.

Computer and Communication Technologies Workshop Attendees

H. Clark Stroupe, *Chairman*
Vice President
Booz-Allen & Hamilton, Inc.

Mike Ball
Department of the Air Force

Paul Baran
President
CableData Associates

W. W. Buchanan
Senior Associate
SES

James Burrows
Director, Institute for Computer Science
and Technology
National Bureau of Standards

Anthony Csicseri
U.S. General Accounting Office

George Litchford
President
Litchford Electronics

Gilbert F. Quinby
Consultant

Harrison Rowe
Bell Laboratories

Robert W. Simpson
Flight Transportation Laboratory
Massachusetts Institute of Technology

Willis Ware
The Rand Corp.

The National Airspace System Plan Conference Attendees

John L. McLucas, *Chairman*
President
COMSAT World Systems

Ward Baker
Airline Pilots Association

Frederick Bradley, Jr.
Senior Vice President
Airline and Aerospace Department
Citibank Corp.

Samuel C. Colwell
Director of Market Planning
Fairchild Industries, Inc.

Barbara Corn
Vice President
BD Systems Inc.

Anthony Csicseri
U.S. General Accounting Office

Elwood T. Driver
Former Vice Chairman
National Transportation Safety Board

Thomas S. Falatko
Deputy for Transportation and Civil Aviation
U.S. Air Force

Matthew Finucane
Director
Aviation Consumer Action Project

Rod Gilstrap
Director of Flight Safety and Industry Affairs
United Air Lines

William T. Hardaker
Assistant Vice President
Air Transport Association

William Horn, Jr.
Manager
Airspace Airtraffic Control Services
National Business Aircraft Association

Victor J. Kayne
Senior Vice President
Technical Policy and Plans
Aircraft Owners & Pilots Association

David Lewis
Principal Analyst
Natural Resources and Commerce Division
Congressional Budget Office

John F. Leyden
Executive Director
Public Employees Department
AFL-CIO

Kingsley G. Morse
President
Command Airways

Gilbert F. Quinby
Consultant

J. Donald Reilly
Executive Vice President
Airport Operators Council International

Harrison Rowe
Bell Telephone Laboratories

Robert C. Seamans, Jr.
Professor of Environment and Public Policy
Massachusetts Institute of Technology

Robert Simpson
Flight Transportation Laboratory
Massachusetts Institute of Technology

H. Clark Stroupe
Vice President
Booz-Allen & Hamilton

Richard W. Taylor
Vice President
Boeing Commercial Airplane Co.

David Thomas
Consultant
General Aircraft Manufacturers Association

Vincent Volpicelli
Supervising Engineer
Port Authority of New York and New Jersey

Airport System Development Advisory Panel

Don E. Kash, *Chairman*
Director
Science and Public Policy Program
University of Oklahoma

James H. Anderson
Director, Office Building Division
General Services Department
E. I. du Pont de Nemours & Co.

Joseph Blatt
Consultant

Clifford W. Carpenter
Manager, Airport Development
Boeing Commercial Aircraft Co.

Pierre Champagne
Director of Airport Planning
Transport Canada

H. McKinley Conway
President
Conway Publications

Charilyn Cowan
Staff Director, Committee on Transportation, Commerce and Technology
National Governors' Association

Thomas J. Deane
Vice President, Operating Facilities
Avis Rent-A-Car, Inc.

John Drake
Professor
Purdue University

William Garrison
Institute of Transportation Studies
University of California, Berkeley

Aaron Gellman
President
Gellman Research

John Glover
Supervisor, Transportation Planning
Port of Oakland

Leonard Griggs
Airport Director
Lambert St. Louis International Airport

Richard L. Harris
Vice President, Public Finance
First Boston Corp.

Jack R. Hunt
President
Embry-Riddle Aeronautical University

Richard Judy
Director of Aviation
Dade County

Alfred Kahn
Professor
Cornell University

Leonard Martin
Vice President, Passenger Services
Piedmont Airlines

Dorn McGrath
Department of Urban and Regional Planning
George Washington University

Sonny Najera
Director
Arizona Division of Aeronautics

Edmund Nelle, Jr.
President
Butler Aviation International

Jan Roskam
Professor
University of Kansas

Forrest C. Six
Vice President
Ralph M. Parsons Co.

William Supak
Aviation Director
Port of Portland

William Wilson
Vice President, Properties and Facilities
Federal Express Corp.

Interest Participation in the Regulatory Decision Process: Lessons Learned From Two LNG Safety Standards

Workshop Attendees

Robert K. Arvedlund
Federal Energy Regulatory Commission

Robert Bedell
Deputy General Counsel
Office of Management and Budget

Daniel E. Bensing
Professional Staff
Senate Committee on Governmental Affairs

Richard Breeden
Counsel
Office of the Vice President

Neil Eisner
Assistant General Counsel
U.S. Department of Transportation

Gary Gregory
Marine Technology and Hazardous Materials Division
U.S. Coast Guard

Philip J. Harter
Harter & DeLong

George K. Horvath
Manager, Government Relations
National Fire Protection Association

David Pritzker
Administrative Conference of the United States

Alan Roberts
Materials Transportation Bureau
U.S. Department of Transportation

Leon D. Santman
Director, Materials Transportation Bureau
U.S. Department of Transportation

James H. Stannard, Jr.
Chairman, NFPA LNG Technical Committee

David A. Swankin
Swankin & Turner

Gregory Tassey
Senior Economist, Planning Office
National Bureau of Standards

Ronald C. Van Meerbeke
Columbia LNG Corp.

Kenneth Young
U.S. Environmental Protection Agency

Technology, Innovation, and Regional Economic Development

Planning Workshop Attendees

Belden Hull Daniels, *Chairman*
President
Counsel for Community Development

William F. Aikman
President
Massachusetts Technology Development
Corp.

Catherine Armington
Senior Research Analyst
Economic Studies Program
The Brookings Institution

Dennis W. Barnes
Chief Scientist
Subcommittee on Science, Technology,
and Space
Senate Committee on Commerce, Science,
and Transportation

Miles Boylan
Policy Analyst
Innovation Processes Research Section
Division of Industrial, Scientific, and
Technological Innovation
National Science Foundation

Charilyn Cowan
Staff Director
Committee on Transportation, Commerce,
and Technology
National Governors' Association

Steven H. Flajser
Professional Staff Member
Senate Committee on Commerce, Science,
and Transportation

LeVon French
Counsel
House Committee on Small Business

Louis Jacobson
Senior Research Economist
Public Research Institute
Center for Naval Analyses

Thomas R. Kramer
Deputy Staff Director
Subcommittee on Science, Research, and
Technology
House Committee on Science and
Technology

Walter O. McGuire
Director
Washington Office of the Governor
State of California

Gwendolyn B. Moore
President
The Moore Group

James O'Connell
Senior Policy Analyst for Economics
Control Data Corp.

Albert Paladino
General Partner
Advanced Technology Ventures

William Scheirer
Economist
Office of Economic Research
Small Business Administration

Kenneth Sherman
General Partner
Cambridge Research and Development
Group

John Stewart
Assistant General Manager
Tennessee Valley Authority

Milton D. Stewart
Editor
Inc. Magazine

Roger Vaughan
Consultant on Regional Development
Council of State Planning Agencies

Robert Wise
Director
Council of State Planning Agencies

Appendix B
OTA Act

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessment Act of 1972".

Technology Assessment Act of 1972.

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

Technology Assessment Board.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

Duties.

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities;

(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and

(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:

(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;

(2) the Board; or

(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where—

(1) to do so would violate security statutes; or

(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 Stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

SEC. 4. (a) The Board shall consist of thirteen members as follows:

(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;

(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and

(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

Meetings.

Subpena.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

Compensation.

83 Stat. 863.

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

Employment restriction.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act.

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—

(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

Contracts.

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory,

or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

80 Stat. 499;
83 Stat. 190.

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

Agency cooperation.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

Membership.

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall—

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

80 Stat. 498; 83 Stat. 190. 5 USC 5701.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing. 92 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156; 32 Stat. 365. 42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,000,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and
No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept.22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.

U.S. GOVERNMENT PRINTING OFFICE : 1983 O - 17-454